Identification of Writer's Gender using Handwriting Analysis

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I.   Introduction

In the world we are living in today, many crimes such as robbery, rape, murder, genocide, suicides and other fatal activities are emerging resulting in high insecurity globally. The increased instability causes fear and panic to people making it hard to carry out their daily duties. Government and other private sectors have come up with ways to handles this disaster by producing various experts who investigate the causal effects of damage and harm. By use of a collection of tool, materials and scientific measure and theories, the experts can investigate and point out the criminals who then face penalties for their actions.

Graphology is the study of the art of handwriting and handwriting analysis which is currently applicable in the assessment of people in industries (Bogan & Roberts, 2011). The analysis is a valid indicator of behavior and personality and therefore a useful tool for many industrial activities such as recruitment, selection, canceling, interviewing, career planning and team building. The study of graphology makes use of three hundred distinct characteristics in its approach to the investigation (Bradley, 2006). Graphologist knowledge is in the comprehension of psychological art which blends with the scribbling features.

II.   Handwriting theory

The script of a person is unique in the impulsive manner that is; the brain apparently sends impulses to the hand which then manipulate the writing tool. Investigating the script that helps the experts to recognize the features in the writing and their interaction (Found & Ganas, 2013). The traits and the relationship between them give information necessary for analysis keeping in mind that no sample can contain all the different features. A single feature does not prove anything but can help identify a trend. Combination of many elements brings about bright and full interpretation.

The current approach of handwriting evaluation came from a definition of the critical aspect of science which is still under investigation (Franke & Srihari, 2008). Qualified graphologists make use of the strict code of behavior, and their expertise is always in demand. Those who utilize it recognize the value for the purpose in which it is related to and helps them in understanding characters (Fisher et al., 2012). Therefore, the analysis is a very crucial tool necessary in identifying the capacity and quality of individual's potential and talents which aid in career guidance and enhancing the relationship. Nevertheless, graphology work becomes continuously used despite its difficulty. It becomes appreciated by many who understand how it works.

III. Introduction of handwriting features

There are many features some of which include;

Size; script occurs in three zones which are upper, middle and lower. A benchmark where one can judge the size per every zone is 3mm per zone making the non-remarkable height of 9mm. Handwriting of large size implies that the person is outgoing and extrovert, it can also mean the writer is trying to show confidence although it may not be present to strangers (Canter & Youngs, 2009). Small

size handwriting is logical but means the opposite indicating that the writer is a thinker and academic based on other features in the script. An excellent and little writing shows that the writer is a poor communicator and they do not socialize appropriately.

Slant; right slant shows communication response but not how it takes place. The author may wish to be responsive, friendly, manipulative, intrusive, loving, in control and supportive (Hennessy, 2013). Upright handwriting shows that the person is independent. On the other hand, a left slant shows reserve and emotion. The person requires being trustworthy to himself first before they can commit to others. They can also be resentful when other try to push them into the relationship.

Pressure; heavy pressure indicates taking the thing seriously and showing commitment, but an excessive application of force shows a quick reaction to what gets seen as a criticism even without the intention of doing so. They react first and ask questions later. Light pressure indicates sensitivity to atmosphere and empathy to others but can also mean lack of vitality or evenness.

Upper zones or cases include letters like i, t, h, and others. The great high stroke aims toward goals and ambitions, but when extended they mean trying to reach unrealistic expectation which the writers feel they must achieve. Reasonable upper zone loop show that the writer is imaginative in a sensible way and like to think things through wider upper region loops show the tendency to come up with ideas and then mull them over. When the up stroke goes up and then falls back on top of itself, the writer wants to get out of imagination and deal with things at hand physically (Wilk, 2013).

The lower zone includes y, p, g. Smaller loops vary and have a different meaning, for instance, a straight stroke indicates impatience of getting the job done. A lower cradle stroke suggests aggression and confrontation avoidance (Huo et al., 2008). A full loop with a heavy pressure applied show energy to make money and possibilities. An entire lower loop with light pressure illustrates the need for security. Lower zones with varied shapes indicate unsettled feeling or emotionally unfocused person.

Word spacing; wide or narrow spacing between words is the space between letters. Larger areas indicate the requirement for breathing space. Small areas, on the other hand, show the need to be with others. It may also mean lack of finesse in writing.

Line spacing; unlined papers are always the best for handwriting samples. Wide spaced lines show the person want to pause and gaze at other people. The lines indicate that the author is observing. A writer who does this especially those that have loose writing structure have the discipline to keep calm when pressured.

Page margin; is the sides of the page. The left side margin indicates the ground and the beginning. The right direction demonstrates others and the days to come. The upper one is the ambition and goals whereas the field margin indicates the strength and instinct, therefore, margins are very educational (Lewis et al., 2006). The writer with a wide left margin shows the interest of moving on, and if narrow he is cautious and avoiding being pushed before one is ready. Small light margin shows impatience and eagerness to leave the place. Finally, extensive light margin indicates the fear of the unknown.

Middle zone; include a, e, c. The letters can give some interesting information whereby they represent the ego from where we acquire knowledge of how the writer feels and behaves in public setting for instance what makes them parasite both at work and socially. Some people scribblings consist of a single style while other have mixed up styles in their writings and this is also necessary for the provision of useful information. These features can pose positive and negative connotations whereby the analysts can use them for interpretation (Szoszkiewicz et al., 2007)

Arcade; means that the middle zone of the script is rounded and humped at the top like a arches series. The style is used in copy-book though not taught in schools. A writer who utilizes it is protective, trustworthy, loyal but negatively secretive and stubborn ore so hypocritical. They have solidarity against outcasts.

Garland; is an inverted arcade where the writer makes their m, n, and h in the opposite direction to form a trough or cup where people can pour their worries or relay information. This kind of writer enjoys helping and being part of something.

Angle; angled middle zone is a style used in the analysis whereby the shape points give the impression of probing, unlike the curves. The writer employ talents at work and other projects rather than nurturing it. The interpretation does not imply that the author requires preventing or categorizing from spreading their talents. The analysis can help show the strength.

Thread; the handwriting is like loose fur ready to be made a fresh. Here, the writers are adaptable, mentally attentive, elusive and have inadequate patience. The author develops a habit of being responders and not initiators. They can be creative at coming up with something new out of existing one. The authors are time cautious and make appropriate decisions (Sesa-Nogueras et al., 2012).

Wavy line; the writing is the most amalgam and is used by mature skillful people for a responsive purpose to suit the certain occasion, and for this reason, it is a way of coming up with the appropriate problem-solving mechanism. Finally, they are resourceful and easily adaptable.

The features and their explanation give a small but helpful lead of the way people behave and more so how they handle their social needs. Understanding individuality through handwriting is an essential way of producing best personal products for all to benefit. The reason behind the use of graphology should always be positive (Morgan, 2010). Interpretation should help the analyzed people to understand themselves and choose the satisfying ways to leave their lives. In a professional context, graphology can help the relationship to work by enhancing the quality of performance.

The more thorough the teams are when doing their jobs, the better the accuracy of the facts of the case. The worth of the evidence and its handling manner will impact the ability of judges in arguing the truth of the situation and coming up with a reasonable conclusion based on the innocence or guilt. Graphology interprets the writing of individuals basing the character form. Through writing the character of a person gets reflected. However, handwriting analysis does not foretell the future, the age or gender but can reveal phobia, leadership qualities, mood swings, ambitions, temperament and thinking clarity as well as the honesty of a person.

Handwriting reflects on the psychology of a population in the paper because it is a projection of what the brain contain (Thibault, 2007). Through graphology, our sub consciousness comes out revealing what we keep inside. It provides an insight of the personality of an individual. Just like there is no similar handwriting, also no individuality can become shared by two. Internal indifference can interfere with the handwriting of a person. This paper seeks to show how the experts can analyze the writing of the writer to determine the age and the sex.

Handwriting analysis is an important task that involves analyzing comprehensive comparison between a known suspect writer and a questioned document. A document is a material with legal markings which may become inscribed and used for different purposes. Analyzing the paper must consider its color, opacity, sheet size, thickness and weight, a fiber content, the grain direction, the water mark and the finish. These exhaustive file comparison of the foreign and domestic paper samples help identify most papers (Broeders, 2006). A typical low-grade kind will show no result to the owner except maybe his operation area. A rare and most expensive paper may trace to the limited category of people and the country.

Secret marking that exists in documents used by banks, government and other officials are also multiple on files along with some stock to aid in checking the quality of the official records. A document can be put into the category of a forged paper when it shows that it is not as old as expected to be. The composition of the journal can provide information about its age and so can the water mark. Often, it is crucial to measure the age effect of the paper's chemical content, fiber and color and the climatic condition under which we locate it. By use of a tint meter and chemical reagents for gorging color shades, the expert can determine the paper age accurately. A practice of forgery become tested easily by revealing the age of the journal.

The age of the ink can also become verified through the data on file by use of vegetable dye inks and other inks which show the chemical difference when used on papers revealing the age of the paper hence making it detectable. Magnification of the ink writing to more than fifteen times show tracks made by the pen which stand out clearer than the ink line between them. A new pen serves in

identifying its type through standard-band width. The use of a worn out pen show two tracks in width indicating that the user is either right or left handed. A badly worn-out pen may leave evidence of scratches that provide identification of the pen itself. A document written in pencil may get determined in the lab whether it gets used ten or fifteen days earlier. Unusual pencil may leave traces to the individual who used it.

Examination of similarities, qualities, and individualities of the documents takes place to discover the standard criteria and distinguishing characteristics between the writings. The known and unknown sample is put under analysis to reveal their differences such as identifying unusual words, letters, decoration formations and other qualities. They then get compared in such a way that grammar, spelling, and punctuation get examined, and so do the phraseology. Finally, the similarities between the unidentified and identified documents are well-thought-out for uniqueness and matching characters consideration. The writings undergo evaluation and judgment made. This analysis focuses on the fact that no two individuals can possess the same handwriting neither can a single person reproduce the same writing.

The hand writing is a physical activity carried out by adults signifies the quality of the writer. It, therefore, can be of use for identification of the author through differentiation of the two writing specimens' one of which is known and the other one unknown. The comparison includes other factors besides the letter forms include the pen position, line quality, movement, shading, connection, retrace, muscular habits, embellishments, and spacing. The obstacle which detects a disguise or forgery of his writing is hence, significant and money fold due to the constant repetition of the same writing over the years leading to a broad habit. For a forger to grow off his habits, he needs to assume a new one that is inherent, and that is virtually impossible.

Understanding handwriting analysis

When scientifically analyzing handwriting samples from a suspected person, they may try to disguise their handwriting though still there is similar characteristic identification in their grammar or punctuation. The writing instrument used can expose clues about the criminal. The scripting feature may include the form, which is the shape, the angle, the slant and the curves of letters. The lines, which shows how thick and the pressure applied when lettering. The layout, the letter arrangement and spacing of letters and words all over the page is crucial. Moreover, the content of the writing which includes the spelling, punctuation and the grammar can confirm if the samples are from the suspect.

Disguise methods

They vary with the imagination and the image of the writer. However, despite the many ways to conceal, a person may alter the handwriting. Only few range of disguise method can be of use by the writer that can affect originality of work. Experimental evidence shows that the overlying element that changes the appearance of handwriting are those likely to make disguise use positively. (Purdy, 2006) The theoretical idea that informs the opinion of the writers are generally under the belief that identification of handwriting occurs by its pictorial along and consequently, only superficial alteration require doing to the writing to impair it beyond comprehension.

Characteristic subjected to the first alteration are those that judge the handwriting appearance. Findings show that the most commonly altered script is as below;

Handwriting slant alteration

This alteration is one of the mostly used disguising features that makes the writing appear leaning or sloppy including any other element that alters the appearance. Being an unusual characteristic of writing slants is a favorite disguise target. Many commentators agree with the statement that use of sloppy writing is the most standard method as well as favorite one of disguise though not agree with it. Studies show that approximately those who participate in the habit of alteration as a mask process are a third of the total

(Mohammed et al., 2011). There is the most preferred direction of slant which alters the handwriting from leftward or backhand slope to one that is vertical or rightward sloping.

The most systematic slant method is from leftward to rightward direction. The first impulse of a lying writer avoids the right slope and changes it to the extreme backhand slope which frequently occurs in the altered writing (Lafone-Ward, 2014). The author aim is reversing their usual slant so that they are not convicted or found guilty. Every writer who alter their slant in the study change it from forehand slope to backhand.

Letter shape alteration

Uppercase alteration occurs more often than the lower case lettering because the capital letters are more suspicious than the small letter Also because the uppercase occur with a higher degree of awareness. Alteration of these letters is hence easily more achievable. Most studies show that across many educational groups there is a change of capital letter formation especially in disguising signature which appears from slight additions or removal of strokes to new letter forms. Some participants involved the concealing of the upper case by changing the overall letters' design. Changing the uppercase letters from cursive to block letters is a most usable device that occurs in about ten percent of the disguise scribbles.

In other cases, small letters are likely to become interfered with, and such modification will only occur to the first of last letters of the word for it will cause immediate notification effect on the overall handwriting appearance. Some disguises use changes that camouflage the small letters whereby they create complete small letter forms than found in the document under investigation. Small letters that were subject to mask included e, r, s, t, and k such that t would appear stretched upward lowering its position or even increasing the final stroke by use of a cross-bar.

 Other disguising letter form aims at embellishment or simplification of the original letters which they call superfluous ornamentation. Similar results show that those who use this type of disguise used the abbreviation in the written characters. Some masks used the unusual manner in the process of changing the slant of their scribbles (Daab, 2012). The particular letter forms show qualities of a naturally turned shaped of abnormal size hence inevitably result to suspicion in spite the use of the disguise version. On the other hand, smaller writing led to less embellishment unlike the use of larger ones which increased mask discovery.

Alteration of the letter size

Modification of the overall size of alphabets is a standard method of revision which is an element of natural handwriting to manipulate and change the features of the overall handwriting appearance. When the conceal size become compared to the standard one of the writer, the writing will automatically show that the size increases. There is a tendency observed where the text size increases the regular hand activity causing conflict among letters. Altering the size of writing increase the overall height of letters than the usual decreased size which directly indicate that cheating takes place. Other evidence contradicts the findings whereby, in disguising the handwriting the subject utilized a format change to eliminate the similarity in the known document.

Modification of Initial and terminal stroke

Presence or absence of strokes can affect the visual complexity of handwriting. In case of disguised signatures, the original approach all the final ones is a method used to alter the writing. Mostly, the writers use the last stroke than the initial one, and some even use both strokes. The strokes affected only t, b, h, and I letters making final stroke restricted to only small letters. Initial stroke became altered by either addition or deletion while the last strokes got added, extended or embellished or emitted entirely. The strokes alteration also included lengthening or shortening the letters in the mainly last stroke which revealed that the greater tendency affected the final stroke and not the initials ones. Use of initial and terminal stroke appeared to be a method disguising signature writing in most cases.

Alteration of connecting strokes

This modification was a disguising tactic only present in several disguises writing. The investigation occurred in only one study in great proposition engaged this alteration. It was typical for the connecting stroke to be converted from angular to rounded linking.

Angular stroke modification

Stroke altering can affect the striking aspect profoundly though rarely used by disguises. Only a few frequencies appeared in the disguised signatures and not necessarily the writing. Only a few affected the writing angularity. The study showed that it is possible to distinguish a clear trend including whether the writing will become more rounded or angular in alteration. In the study, thirty percent produced leaner than seventy percent which created the rounded book. Those who interfered with the angularity of the writing did so by increasing the size of the stroke apex angularity.

Upper and lower extensions modification

The ascenders or descenders in their lower cases include p, j, f, y, b and Q which are prominent making the susceptible to inspection to discover the intention of the deceiver. Almost half of the suspect reject their standard methods of forming the lower and upper loops and substitute alternative forms. A writer who habitually used loops extension would either change the size or omit the loops entirely. Altering the bottom extension in the disguise act is more significant unlike using above projections.

Unskilled or adopted careless writing

It is not possible for any human being to write in hand more technical than his usual handwriting. Although, despite the principle, it is possible for a skillful a hand to pretend to write in an unskilled manner by deliberately writing sloppily and carelessly. This awkward writing is a method of disguise whereby the writer introduces illegibly features with the aim of escaping the actual evidence. Altering the signature by use of sloppy handwriting with the intention of failing to be discovered was among the greatest ways of disguising. Only a few writers choose to change their signature making them suspect even more by producing dirty and challenging work to read.

Writers can also try to disguise their writing by intruding artificial tremor with an impression that they will look as if they use drugs or alcohol. The use of this tremors the writer appear to distort the writing affecting the minor features by making them less apparent. It is doubtful that there will be the maintenance of consistency in writing. The smoothness area where tremors fail to exist may assist in providing identification and proof that there was the use of disguise. In reality, it is impossible to differentiate between real tremors of a fake one hence not possible to realize the mask process.

In other cases, there is speed alteration which is a very used method whereby the writer scribbles hastily or slowly as a way of hiding the identity. There is a weak conclusion that the speed used s the writers' way of scribbling typically. The overall writing appearance gets affected by the way writer arrangement or organizes their writing on a page or any other document. This activity alters the arrangement habit hence causing disguise. Space alteration occurs when the mask compresses or expand the letters or words with the aim to change the appearance of the writing. It is still an issue where authors space their work as a way of disguising or out of panic.

Mirror writing as a disguised method includes employing the non-dominant hand which runs in the opposite direction to the known pattern. On the contrary, pen pressure alteration is the degree in which the writer is cautious about his normal handwriting and therefore uses the right or increased pressure of the pen, as a consequence of increasing or reducing speed (Niels & Vuurpijl, 2005). Writers successively mask their writing by using thicker or thinner pens which affect the general book appearance. Deliberate letter omission as a disguised method is a form that successfully works for the disguises when creating the receptive signature and so the deliberate misspelling (Leung, 2014).

Disguising numerals as a rare of the occurrence in the real scenario which goes hand in hand with the observation made in the experimental literature. In other occasions, criminals take advantage of combined disguises to cheat and alter the writing. Therefore, making it hard for the investigators to identify the writing or the signature.

The Process of the crime scene activity for evidence evaluation, help in the determination of the sequence of the events. Documents that relate to the scene may include crime confessions, threatening notes or even suicidal information that resulted in the offense. The forensic scientists look for the handwriting, inscribed carbon papers, photocopies, diaries or even shredded papers (Murphy, 2008). The questioned document undergo comparative examination, and the sample that goes through future analysis may relate to the copy of the criminal. Significantly, the sample in its original form is better and purposive, unlike the duplicate. The more the document under investigation the better the comparison hence quality conclusion.

With the use of the microscope, both handwriting and signature matters amongst other parameters show the relationship and variation making it a precise method for examination. After a detailed study, there is a likelihood that the specimens were from a single person through the qualitative probability may vary significantly. Limitations to the investigation will show qualified findings. A well examined forensic work contains many facets and requires the use of multiple scientific methods and range of instruments in the laboratories.

Consequently, the clues in the letter help investigators in determining whether the subject is telling the truth or lying. The reaction of a writing originates from a subconscious mind which at times can provide the impression to the psychologist that the one who fears from the idea do so, for they do not want exposure. The writers who embrace the writing are the type that tries to pry and snoop. Whatever the reason the proposition is the right approach for commencing a disagreement. Handwriting analysis art has two division one of which is an established and the other respectable branch. One who seeks to identify individuals by their writing is a subject of the paper.

Character assessment is a distinct activity of the humanity itself hence difficult to carry out. A short article can provide an outline of the involved theory which psych the investigator to proceed with his study more precisely with the aim of getting the matter solved. Prior the writing the suspect may stop and think what he is writing leaving a space before returning to give false information. The sudden change in the writing slant mid-page is alerting the analyst where to focus. The shift of emotion indicates that the person is deceiving the explorers. The handwriting analysis applications may take place in law enforcement hence, taking the information from a suspect or victim can increase the truthfulness of the matter because the script exposes the writer's motives. Identification of the reasons can be of advantage to the investigator.

Every individual has a motivation in meeting the same needs which include water, food, air, security, love, esteem, and respect. Life experiences may cause one to desire some needs more than others. A quick involvement with the subject affairs helps in gaining their trust allowing them to be open easily and faster. A suspect motivated by the desire for respect will require a different approach, unlike a victim who needs love. The statement will show the areas requiring further pursuing. Handwritten papers produce better information unlike the text messages and therefore an in important tool for analysis.

Under forensic science handwriting analysis require experts called QDEs (Questioned Document Examiners) who look for alterations and forgeries and then compare the result with the original sample available. Each is unique and has a different style of lettering. The QDEs search for differences in the document instead of similarities to determine the presence of forgery. They, therefore, look into letter form, sentence form, and formatting. Simulation is the process of disguising a person's handwriting or the attempt to copy another's. It is a huge challenge for it make it harder or even impossible to determine the questioned document.

The simulation can follow some factors that lead to its identification, and they include shaky lines, lots of pen lift and dark, solid starts and finishes for the lettering. These elements are present in forming letters slowly and carefully rather than the usual, natural work which is done quickly without a second thought. Through replication handwriting analysis can make inaccurate though, other features of drug, illness, exhaustion and human errors can cause unviability of information conveyed.

Police are the first people to arrive at the crime scene. Where a crime involves a handwritten note, they may call the experts so that they can match the case with the criminal. In other situations, the note might be the only evidence that makes the suspect charged and even sentenced. Therefore, the analysis fruits are only available when the document found undergo some lab analysis. The questioning of the material is the obligation of the officer who first arrives and receives the document and finds out that it does not fit with the known case pattern. The duty to ask for assistance in analyzing the written material connected to a crime has often been a crucial decision made during the criminal investigation.

Protecting disputed document

People neglect paper after folding, stamping, marking and filing them. The neglected paper may be in such that it can no longer be of use due to the reduced storing condition and therefore, the disputed document should receive protection so that the writing is legible and maintains the original standard. A covering is put to protect and keep it safe until the analysis period. Guidelines followed in the maintenance of a document include the 'do's' and 'don's' which can help address complications and problems related to poor storage. They include;

DO'S

Keeping the document in a dry place, away from excessive light and heat that can affect the quality of the paper.

Keep the papers unfolded in cautious envelopes.

Take the papers to the examiner's lab when possible as the first activity.

DON'TS

Don't allow anybody except the specialist to carry out the test.

Do not mark the disputed document or point at them with a pen or a divider.

Do not carry the disputed papers for an extended period.

Do not damage the paper by refolding, tearing or punching for filing purposes.

The disputed material is relevant enough to undergo investigation hence deserves proper treatment care. The packaging of the evidence to avoid losses, contamination or breakage in transit is important. Forceps, tweezer, and other tools are necessary to collect large and small items into the containers. Use of rubber gloves when handling evidence is crucial (Gawda, 2008). Each document should occupy its package so that they do not interfere with the clarity of the information. Envelopes marking should take place before packing the specimen. Only the documents belonging to the same exhibit get put in the same container. For accuracy of comparison analysis, the sample collected get packaged in different containers to avoid any close contamination. Therefore, only thoroughly, cleaned and dried corrugated papers, containers, wrappings, sealing tape are essential for evidence transportation.

Guidelines for exhibit packing include packing safely to avoid damage, to prevent contamination, uniquely labeled to prevent confusion, sealing containers with an appropriate seal, fragile documents get put between cartons to prevent damages and breakage, packaging samples affect their integrity and should be appropriate. The results from the modified sample can be of great challenge in the law court. Marking of the evidence help in identifying it though it should not impair the quality of proof or restrict examination procedures. Therefore, suitably marked envelopes should be of significant contributions to the examiner or rather putting two covering letters to accompany the exhibit is preferable.

Individualization means the uniqueness of things which can, therefore, become separated from the rest. All crimes undergo individualization because they relate to a particular person or persons. Individualization implies that; that one identifies an object and compares it with the original one with the view of determining the uniqueness. Through comparison, the individualized sample can relate to a single person by uniqueness portrayed. Also, through individualization, a conclusion determination comes through whereby the experts get all the required feature that correlate between the characteristic found.

Handwriting as an individualization procedure

Each writing is unique based on the individual nature which must become recognized by the experts so that individualization takes place. The experts' knowledge of theories and practical experience determine the analytical method used to examine the document. Therefore, it is of great importance to comprehend that no handwriting in all aspect can be identical. When distinguishing writing elements like variation should be put in significant consideration to determine whether it is alien, abnormal or normal. Negligence of some factors may lead to a deductive conclusion which is improper.

One should be exclusive when proving the writer of the questioned document such that no further explanation can come from keeping in mind of the possibility of imitations and the resemblance. The fundamental principle that individual feature possession exists in every handwriting explains individualization (Batchelder et al., 2009). These essential characteristics provide distinct individuality in writing and must be detectable before individualization process occurs. Handwriting character occurs in the presence of different spacing, letter shape, stylistic errors and line quality. This uniqueness of writing that assists in determining the perpetrator's individualism. Therefore, it is crucial to check the letter sizes, spacing and the quality of each line the slope and slant of his writing style.

Handwriting in individualization process

The process has three stages that exist as follows;

Discriminating or analysis element determination; both known and unknown items undergo analysis study or examination to reduce the subject matter to its elements. These include the behavioral habits which differentiate between products that may be precisely measurable, observable, or perceptible item aspect.

Comparison: the element of the unknown object determined through the study must undergo comparison with known visible records of the specimen.

Evaluation: similarities or differences in each item show the particular value that helps in the distinction of the samples which aid in explaining the result.

Whether information is graphical, numerical, physical or chemical, the resultant comparison must be visible. Where a large population is high modern technology may apply. Comparison task is difficult hence require scientifically mature participant (Bozza et al., 2008). Consequently, comparing the elements must consider pen movement or other instances to produce accurate information. All crimes management should be in such a way that all valid evidence can be gathered from it to ensure successive conviction and prosecution. The integrity of the sample must remain intact through the maintenance process. The investigation should follow all law parameters. Gathered samples should be properly marked after collection and preserved appropriately to maintain the value of the necessary information.

Handwriting in crime investigation

The primary study purpose is to gather facts that provide evidence before the law court hence resulting to proving the accused participant guilty or innocent. The ability of the expert to acquire and collect the data and use it in his study to get the needed evidence a daily activity to determine their fruitfulness. The officer in charge of the investigation must possess varieties of skills and most importantly the ability to know where and how to find the necessary information to act as proof. Handwriting is a way of expressing words in the form of a language such as speech which leaves the long lasting effect. Handwriting specimen, therefore, is a compact set of authors experimental unit which when adequate contains the required information from a known source (Taroni et al., 2012).

A sample in forensic handwriting analysis, handwriting recognition, and signature verification refer to a handwriting specimen. Out of habit sub conscious pattern series forms scribble. Identifying lettering on documents of a particular person is possible. Again, the investigator may be able to recognize the handwriting on the document to be of the perpetrator previously examined which rarely

happens. A report includes letters, text, database and spreadsheet file or even any written piece of information produced or given to an organization or an individual. Handwriting specimen include collected and requested samples (LeBrun et al., 2012). Requested samples are signatures which aid in conduction of handwriting comparison. The example occurs when a person requests for the script service assistance from experts.

Letterings executed at the investigator's request get referred to the required standard. Collected standard preferably are the materials gathered for investigation work because of their natural or healthy products in most cases (Turvey, 2011). These rules are similar to the questioned writing in that they possess similar letters, letter location, and combination which may be difficult to find or may fail to exist in advance. Message construction, their connection, their stroke, and height together with the spacing of the words and letters include all the characteristics necessary for comparison. The shading, size, skill level and speed are also inclusive.

On the other hand, asked writing get influenced by conditions and know they are subjective to in some examination. If the author is the actual writer that request the copies, the alteration of the specimen may exist and if not circumstances may induce nervousness that may affect fluency of scribbles. For one to compare the handwriting samples requirement is necessary from individuals considered to be the writers meeting the following conditions;

There must be enough examples to show the habit in executing the questioned parts and also to rely on the consistency of execution of particular practice. The natural writing varies from one location to the next, and from one individual to the next unlike when using machines like photocopying device. The standard of writing must be sufficient to reveal the range of variables involved. For practice or skill hands six signatures extended in one or two pages may prove sufficient while we for other the necessity may increase.

The samples duplicate the nature of the questioned writing. Many obstacles may interfere with the handwriting of the individuals which include the temperament, age, circumstance as well as writing tool. The duplication of the standard extent varies based on the controllability of these variables. Therefore, the comparison will exist where materials are alike and similar age combination, words or phrases and also by use of the same paper and instrument. The similarity in the writing features may provide insufficient evidence hence cannot define the conclusion where the suspect become convicted.

The samples consist of both the requested and the collected ones. The obtained standard indicate the reliance degree placed on the required writing which may fail or get tampered. Connected standards are mostly the repeated habits in a regular book and can be more contemporaneous with the previous document. On the contrary requested document can give duplication of letter combination of the experimented materials.

The collected sample includes some original ink which has a three-dimensional letter ring to them in that the aspect of control of instrument especially pen pressure and position may become calculated or observed. Such characteristic of scribbling may be crucial in the studies.

IV. Purpose of writing

One may write to express many things which are happening in their lives or the plans to harm others. The reason behind the book may include: plotting to do harm or evil to others through threatening notes aiming at stealing, squandering and despise. Some devious intention may encourage the person to write their motives. Therefore, the person writes carefully and consciously like an imposing criminal threat on the script. Another reason for writing maybe due to impatience and agility hence it is a slow writing technique adequate only for the slow thinker to the individuals who are thinking ahead, the action becomes an irritating one.

The agile mind may act to the drug for example in a cruel manner tormenting them in the paper. Similarly, some may write to express the emotion and others fatigue. The impact will show in the journal which certainly will vary with this traits especially if the person is carrying out disagreeable chores that require a lot of output and concentration. Others do write to show their emotional disturbance

hidden from the active mind. A pen, therefore, becomes driven by the increasing emotions will move differently from that of a calm person.

A person intending to commit a rape murder case will reveal his intention in his writing. The shock of previous experience may show scarce and may lead to struggle when trying to indicate the kind of torture, game and other things that may remind the person of the past. Writing is also an act of docility and truculence in case certain standards do not succeed. In this case, individuals who like to make things harder for others can have a great chance of distorting their handwriting to make the reading impossible. Those who fail to conform can also cheat in their writing and so will the gentlemen who are afraid of being made accountable for what they wrote.

 Writing can reveal some social attitude in the form of communication which may reach out to and influence many readers. How the writer points out his matter of common sense reflects his view. A courageous outgoing and trusting writer who is cheerful will always close to the next page differently unlike the person who hate and fear people. Some authors engage in writing to reveal their appearance and therefore, they tend to write in a manner in which they feel necessary. Moreover, his taste, the look will show in the script.

The work of the responsible officers is to bring back to life the dead files bring out their new identity necessary for comparison. Handwriting found on a certificate of ownership, a piece of paper collected at the scene, and offset of ink on a blotter, notices in a memo book or any other writing proof to be of use after analysis. Great care in the collection a preservation of documents submitted is necessary for maximum output. The uncontaminated material carries the highest quality evidence and anything below that, that is, a photocopy is better than nothing but has little-qualified yields.

The forensic analysis involves other factors such as DNA testing, crime scene investigation, voice identification, fiber analysis, narcotic analysis and fingerprint analysis. In the area of questioned notes, handwriting analysis is a fundamental part that involves examiners study for some alteration, faking of the available document. It is a repetitive activity that relies on broad knowledge of the way people shape their letters, identify the uniqueness of each letter formation as well as discovering of physiological processes behind the note.

As a science, handwriting analysis involved primary school learning of how to shape and style the letters. It involved students writing the same way, but over time each developed their style leading to distinction. The analyst undergoes training that enables them to distinguish individual characteristic from style features accurately. Personal virtue is most significant part of forensic analysis. Comparing to documents that relate to known and unknown authors starts by checking the differences and not the similarities since they are more. Therefore, after discovering the differences, it will tell if the same person wrote the two materials. Sufficient dissimilarities in the distinct characteristic without disguising the copy of the handwriting show that the documents were not from the same person. However, little differences with enough similarities in the traits of the two papers demonstrate the possibility of a single author.

V.   Materials and Methods

Collecting specimen

Questioned materials may include wills, titles deed, contracts, identification cards, seals, stamps, checks and handwritten notes. Other documents originate from machines and include faxes, photocopies, and printed materials. In some cases, digital signatures and graffiti get put under examination. However, these documents cannot provide the type of quality evidence required. Documents that don't contain identifiable markings that are visible may provide quality impression when underneath under similar documents during the writing process. The reconstructed shredded material can be of great help. Moreover, rubber stamps, writing instruments, envelopes and other office equipment in possession by the suspect may be valuable when in the hands of an investigator. In digital

materials evidence may be hidden from the metadata of files, hence providing information that aid in the tracing of the suspect and the age of the script.

The known specimens collected by investigators is crucial in determining the comparison of information of the material in question. These samples may be from any source so long as it links to the evidence be it a machine or an ink manufacturer. Areas requiring handwritten samples are put into two categories that include; collected scribbled specimen, which involve document got from the scene and requested writing examples, which are materials from required by the specialists (Chapran et al., 2008). These specimens are carefully made under special conditions with the author get investigated. Sources of the sample may come from items like letters, canceled texts, diaries, medical records, and signed receipts, tax files, and other legal documents. Analysis of the writing materials requires qualified forensic examiner such as Senior Digital Forensic Examiner in Abu Dhabi.
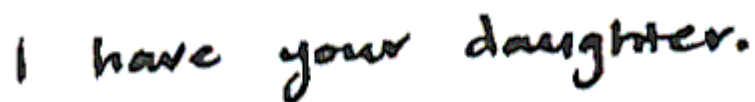
Analyzing a sample

Evaluating the scribbles is an extended and careful procedure that consumes a lot of time, under appropriate circumstances, considering lots of comparison of samples. It is not a matter of looking a letter and concluding that there is a similarity rather it requires an extreme critical thinking to distinguish the shape, style, and format of a word structure (Risinger, 2010). There are real variation within a single document in a person's writing, for example, having eight questioned document and eight exemplars from a single suspect show that the letters and the words in both text have similarities if the person is the author. This profession deals with thoroughness and not guess work.

There is a use of a microscope or a magnifying glass in the comparison process where the analyst looks deeper into the individual's traits. The examined document require lots of magnification equipment whereby hand magnifier enlarges materials from two to ten times and may include some writing capabilities as well as brightening the field of view. Many types of microscope show details more carefully. A binocular microscope is efficient because it has two eye pieces and the viewer can focus on both eyes. Moreover, the microscope has a third viewing tube that allows a video camera attachment for videography or photography.

Digital microscopes can combine visuals for enlargement with digital capture technique that allows the viewer to see the enlarged image on the computer's monitor instead of using the eye pieces. Starting out with little power is ideal for the first examination of a document then zooming in closer to the inspection area required. A comparison microscope is the most crucial type of review of a record. Two scripts get viewed side by side after positioning the images closer to each other (Tilstone et al., 2006). Use of different filter color in each document by the examiner lead to viewing the two segmented areas overlapping each other.
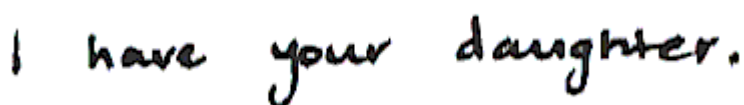
After a kidnapping scenario and a letter put near the door. It contains the following information that required the expert analysis.

The document under investigation.

The suspect under questioning gave a sample that related to the same message and included the copy below.

Suspect's document.

By the look of the two scribbles, they do not vary enough to declare that they got produced by two different people. But on closer glance, they appear quite similar and therefore require a table that shows the varied form of each letter present in the questioned copy. Discovering an "a" that looks similar to the "an" in the table, it becomes skipped since the interest comes in where distinction exists. Each letter copy gets taken by use of a digital camera in step by step process. Separate table's usage in differentiating upper and lower case letters is significant.

The comparison becomes shown below.

The same kind of the table follows showing the suspect script as shown below.

The two tables get compared to find out if there is a match between them. Since it is a single sentence, there is a restriction of choices. Potential matches for every letter shape and structure under real circumstances would be present to discover a perfect match for the letters in the exemplary that occurs in the questioned document.

The questioned and exemplar tables

For generalization purposes, the tables get put side by side for comparison of the initials tables. A match is evident in the two document hence the same person wrote both scripts. The issue comes in where the person discovered was trying to disguise the text. The results lead to incorrect data hence making it hard for determination of the actual kidnapper. Fortunately, there are ways in which investigators can recognize forgery from a script. They include the use of dark and thick starts, shaky lines and finishes that appear dull. Again, there is an identification of lots of pen lifts that result to a slowly and carefully letter forming rather than quick natural writing.

Gender and age analysis.

Handwriting analysis can provide little information concerning the personality, age, sex and intent of the writer. After analyzing many writing samples over several years back there are still seem no accurate telling of the age of the writer from the script (Harrison et al., 2009). Though, an experience can give one the ability to guess the author's age which can be wrong at times. Records show unavailability of research that determines the accuracy of factors like gender and age. The analysis reviews some trait and nature of a person in that a fifty-year-old woman can appear to be immature in her writing while an eighteen-year-old teenager may possess maturity. Therefore, it was difficult to predict that the age of the person based on scribbles.

The sex of the writer, whether male of the female cannot show evidence that the writing is from either of them. Though, the handwriting can still tell whether the writer has the feminine or masculine characteristic. The age of the person is not evident in the handwriting but can reveal the maturity or immaturity of the personal emotions.

Classifying handwriting into different groups include the following nationality, age and gender have several purposes. In forensic science the classification of writing aid the investigators in focusing on particular groups of the writers (Jiayan et al., 2005). However, the only little investigation got a chance to explore this filed due to limited understanding and its different characteristic. Classifying handwriting into demographic type get carried out in two steps that include classification and feature extraction. For a system to perform, there is a dependence on the step of feature extraction that helps in characterizing elements making it possible to differentiate.

Several geometric elements in this study are necessary to propose characterized handwriting and take advantage of the element to carry out the grouping of handwriting about nationality, gender and age (Peterson & Leggett, 2006). Combination of this features uses an analysis method known as random forests and kernel discriminants. The rates of classification received from an individual dataset show that there is 55.76% for the range of age prediction, 74.05% for the prediction of gender. 53.66% for prediction of nationality when writers produce the same writing text and 47.98% for the prediction of citizenship, 73.59% for prediction of sex and 60.62% for the prediction of range age where the writers use different handwriting text.

Categorizing handwriting into handedness, age, gender, and nationality helps in the application of several classifications in the field of the forensic domain by use of classes of the script to investigate and categorize suspects based on their criminal activities. Also, taking each category separately and processing it would lead to better results in the discovery and verification of the writers (Sommer et al., 2008). Many experts made a proposition of a system which categorizes handwriting into social categories by use of macro-features introduced in the individualism of writing. The featured deal with items like paper movement, stroke formation, pen pressure and word spacing and proportion.

After investigation writer gave feedback that there was an increased classification accuracy of 86.6%, 77.5% and 74.3% for respective age, gender and handedness category. Unfortunately, in this case, the writers were to produce the same text which is not the case in many criminal activities around the world. Therefore, real forensic work becomes unreal. Moreover, the data include the study is not available in public. Other authors carried out handedness and gender in the internet system which provides temporal data about the

writing (Karki & Singh, 2014). These authors made use of twenty-nine features set which became extracted from both online and offline information where the offline representation and the applied assistance received from the Gaussian mixer and Vector machine model to carry out the classification. The report showed a performance of 84.866% for the handedness category and 69.06% for gender group.

Recent studies published by the author in separate cases that focused on the fulfillment of the internet mode and offline mode where the result for the offline system was slightly better than probability event by 55.39%. There is a proposition of a new technology that helps to detect the nationality, gender and the age range of the writer based on handwritten document (Mouly et al., 2007). A group of novel features become proposed and elaborated including the curvature, directions, tortuosity, edge-based directional feature and chain code. The features get mixed by use of different classifiers including the random forest and kernel discriminant. These methods become evaluated by use of QUWI database the only public dataset available; Theta contains annotations concerning age range, gender, and nationality.
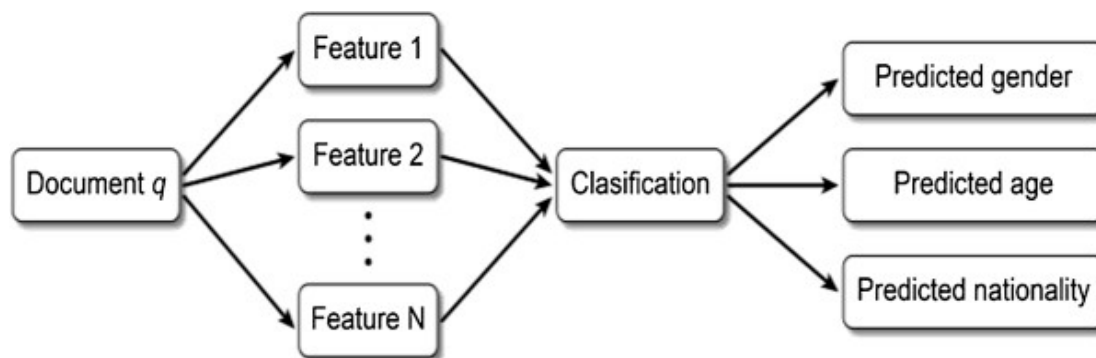
General scheme

The procedure in use consists of two main steps that include classification and feature extraction.

2 Feature extraction

According to this step the characterizing elements get removed from the handwriting such that the pen is independent, images get first categorized into two whereby Otsu thresh holding algorithm is used to make the system (Nicolas et al., 2015). The subsections involved describe the features that are present in the study. The features do not agree with a single term but their definition gets based on PDF obtained from the writing pictures to give traits of the writer's personality. PDF explain the possibility of different features taking a given value. The developed elements and the equivalents are used in legal action by the document examiners and graphologist to give distinction between the various writers' categories.

Direction feature (f1)

The method is useful in the writers' identification. Its use closely looks like the one proposed by another author like Matas. First, there is a computation of Zhang skeleton of the binary image. The frame does not produce parasitic branches as other skeletons do. The structure undergoes segmentation at its connection pixels than the pixel become traversed by use of predefined order that favors the four neighbor of connectivity. For every pixel, there is a consideration of 2N+1 that neighbors pixels that get positioned at the center p. There is a linear regression of the pixel that provides the proper estimation of the pixel p tangent. The N value becomes empirically set to five pixels found throughout the paper. The PDF of the resultant direction shows the random sector for which the empirical set value size is 10.

Curvature feature (f2)

In the examination of the forensic document, there is a shape acceptance as characterizing feature. The method gets adopted as follows where every pixel p that belongs to the contour, the experts consider it as a nearby window of size t. Inside the window computing the pixel number (n2) and the number of the other pixel (n1) that belong to the foreground and the background respectively. The difference (n1-n2) positive where the point on the contour is negative and convex at the point where the contour is concave making it a good indicator of the shape local curvature. Therefore, the curvature get estimated as C= (n1-n2) ÷ (n1+n2). C occurs on the binary shape where t is 5. The PDF, on the other hand, is set to 100 making the computing curvature the novel in the offline fields of writer categorization and identification.

Computing curvature

On the curvature above the red color represents maximum curvature while blue color represents the minimum curvature.

Tortuosity feature (f3)

The feature aid in distinguishing between the smooth writer and the author who write slowly to produces a twisted writing. For the estimation of this curvature every pixel of the book, the longest line segment that cuts across p determination occur and gets included in the foreground as shown below;


Tortuosity computation

a- represents the length of maximum crossing portion where red is the correspondent maximum length and b- blue the minimum one. The PDF or the longest traversing section of the angles become produced in the vector with of size 10.

Chain code feature (f4 to f7)

Through scanning of the text contour which generates chain code and assigns to each pixel a number that relates to its location concerning the other pixel.
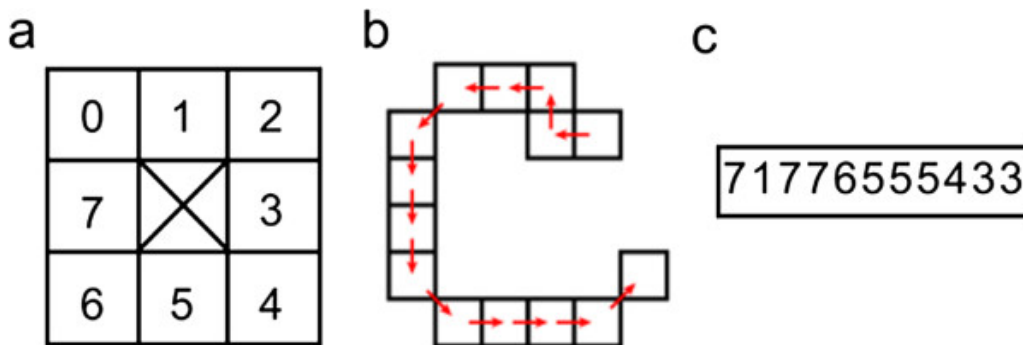
a- Chain code generation order, b-shape, and c-corresponding chain code

These features make it easy to categorize a sufficiently detailed curvature distribution in the handwriting where the chain code occur at different orders as below;

F4 is the PDF of I forms found in the list of string code in that I represent 0, 1,….,7 of size 8.

F5 is the PDF of (I, j) forms found in the list where I, j represent 0, 1,.....7 of size 64.

F6 is the PDF of I, j, k and f7 of I, j, k, l of sizes 512 and 4,096 respectively. Not all the forms of the succession of the chain code can get achieved such as the system from 1 and 5 and therefore, the PDF equal distribution is 0.

Features of edge-based direction (f8 to f26)

This features give a full delivery of the leadership and can occur in several sizes by positioning the window at each center of the contour pixel. Then, counting the number of occurrence of each direction.
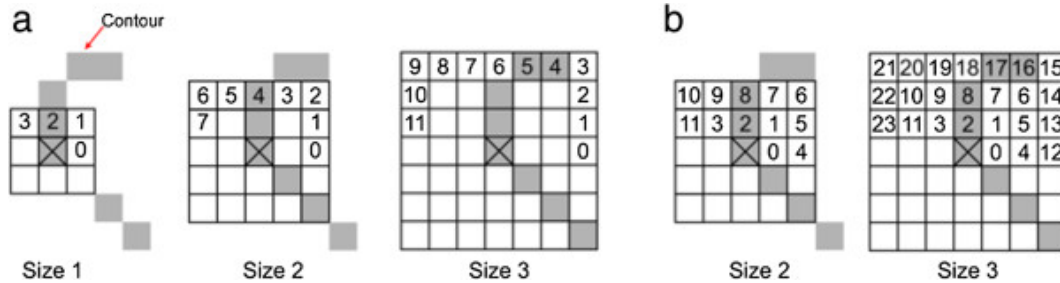
The features get computed from size 1 of PDF 4, (f8), to 10 of PDF 40, (f17). There is an extension of these traits to include both the contour of the free window and the whole window computed from size 2(f18) of PDF 12 to size 10(f26) of PDF 220.

Classification

In this step, the features get used to deciding the category each scribble belongs. When carrying out the classification of each trait of the vectors get used as an individual input for the categorizer. For example, f1 is an input of element vector 10 for the classifier. The combined features when using the classifiers analysis with the help of spectral regression which becomes given as follow; application of the two classifiers become justified by their capability to train on massive databases and achieving higher rates of classification.

Random forest classifier

It is a method of classification that works by making a lot of decision trees during training time and producing a class which represents the mode of the classes. In this case, the classifiers use R forest library which is random.

Use of spectral regression in KDA (Kernel Discriminant Analysis)

SR-KDA requires solving a set of problems that involves regression where computation of eigenvector is not present. By so doing there is an improvement in the complexity of computation allowing large matrices to get handled.

$f(x) = \sum_{i}^{n} = 1 n\sigma i K(x, xi)$

The resultant classifiers in the classification become presented on QUWI dataset

Evaluation

It involves describing QUWI database then analyzing the results as shown;

Dataset

The dataset represents the gender, age, and nationality of the writers who produce one text and another text that differs to all writers. The writers have different ages, genders and come from different countries. There exist only a few left handed writers useful for handedness detection. Seventy percent of the dataset become used for training and thirty percent for testing the analysis which gets completed in the data set involving 1017 writers. Each feature correlates to a PDF of several sizes which is a separate predictor

(Holekian et al., 2014). There is the combination of the predictor by use of random forest classifier used for the features category and as well use of spectral regression in the analysis of Kernel discriminants. From the dataset, three classification tasks become defined. Classification of the age range where seven varieties were used to avoid minimal patterns ranging from 1950-2012. Random classification represented 14% prediction. Prediction of nationality where eight countries were useful each representing more than 30 writers (Layton, 2011). The random grouping predicted approximately 12%. Finally, classification of the gender was the other task where after arbitrary classification it predicted about 50% since only two sexes got involved.

VI. Results and Discussion

Correct rate of classification for every category of the feature that uses the random forest of 5,000 trees and the analysis for each age range, nationality, and gender classification. The first step is separately carried out, but in step two there is a joint activity. Results received for each similar text, and different text gets reported and summarized as per the graph a, b, c
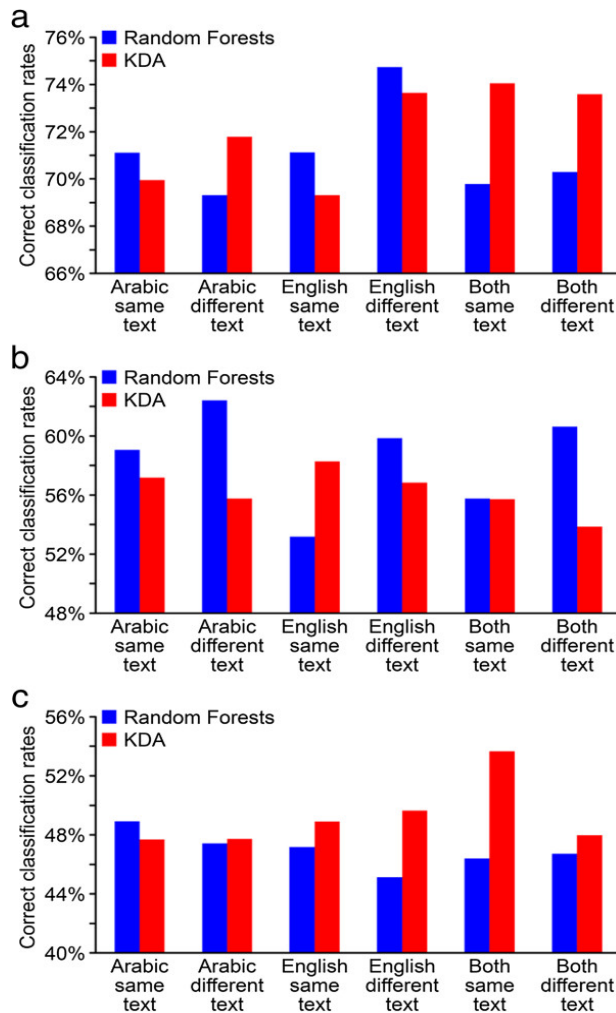
Excellent classification rates by use of RF and KDA for (a) gender, (b) age, (c) nationality.

To test for optimal feature combination for every classification problem an average performance plot for the geometric features (f1-f3), functions of chain code (f4-f7), functions for edge-based directional (f8-f17) and filled features for edge-based directional (f18-f26). The results seem to be very high for the nationality, moderate for age range and lower for nationality detection (Pervouchine & Leedham, 2007). This result occurs because nationality prediction is a dual classification problem where by the random prediction would score 50%. The results for age range and nationality include seven and eight class classification problems where the classifier would only get 14% and 12% concerning each other.

Chain code-based features out do the rest when predicting nationality and gender. The result implies that the curvature distribution in the handwriting is of great importance in realizing citizenship and gender. The proposed geometric features perform more compared to others for age range prediction which suggest that all the curvatures, tortuosity and direction are crucial for determining the age through the handwriting (Selan, 2009). The average performance of KDA classifiers and random forest when joining all the features together (f1-f26) means that the random forest gets preferred for nationality and age range while us KDA is better for gender prediction making random forest preferable for many classes prediction and kDa for binary classification.
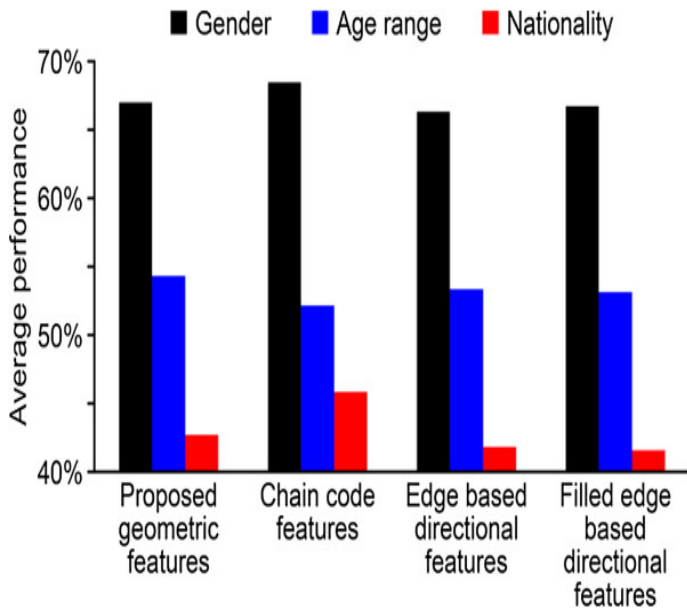

The average performance of RF and KDA categorizers for the prediction of nationality, age range, and gender.

It is crucial to note that handwriting produced by one individual give better results for gender prediction and not for nationality or the age range. Meaning that working on different or same texts do not have any importance in improving the outcome classification.
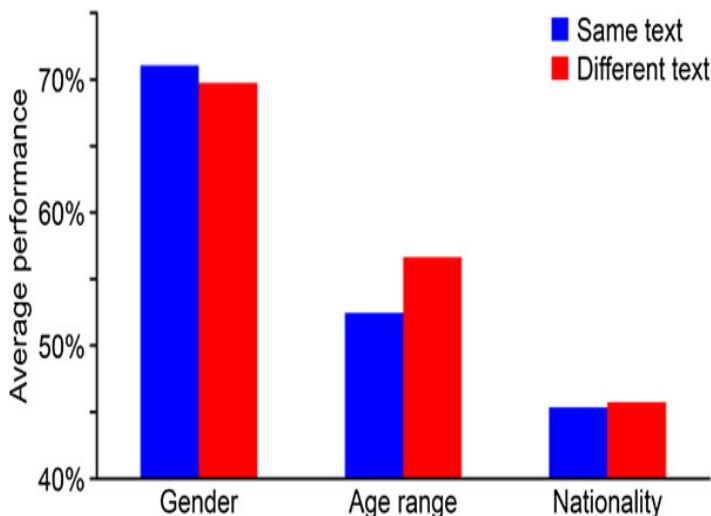
Average performance for different and similar text
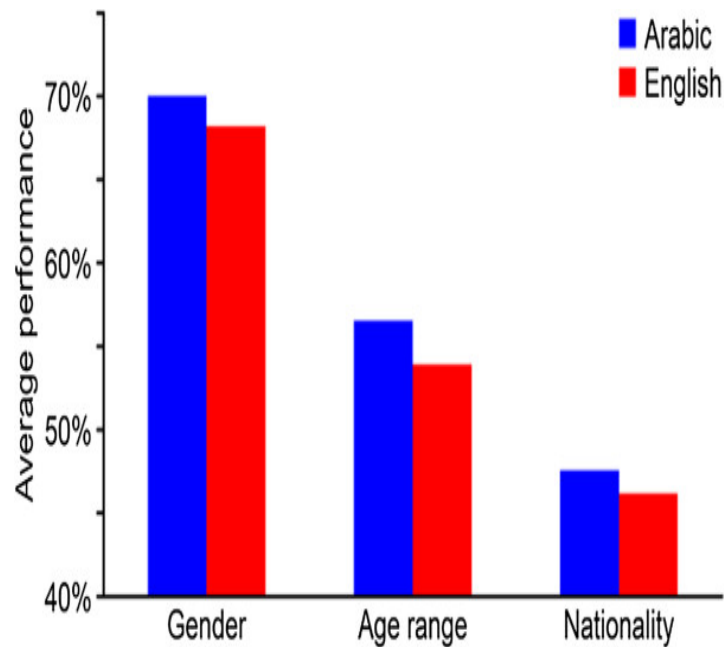
Average performance for Arabic and English text

We combine all features to acquire the average performance of f1-f26 on English and Arabic text. More than English version Arabic handwriting produce better prediction results which become explained by the Arabic text complexity which aims at helping in classifying writers. Moreover, combining several features do regularly not provide the required yield. One feature in other cases may produce better returns unlike when using the many future combinations. Some features appear to be irrelevant hence need removal for better performance. The classification system is better compared to the first ones, but there is still more space for improvement of classification methods and using new features.

The dataset used in this methodology gives room for research purposes. Finally, for comparison activity, the average gender classification results are beyond 73 % which consists of 200 writers. The results can rhyme well with 77.5% for 800 individuals who write the same letter. For the age range classification results the accuracy is 86.6% that out performs the present 55% .however, the writers only include the category below 24 and above 45 years who in total accounted for 650 individuals.

In conclusion, this method uses geometric features for gender, age range, and nationality of the handwriting applicable for English and Arabic documents based on QUWI dataset. The results show both text-independent and the subject class category classification. Using chain code based characteristic usually outperforms other traits for gender and nationality predictions (Saks & Koehler, 2005). The proposed geometric attributes also out do others for carrying out age rage prediction. Random forest results are preferable in the prediction of nationality and age range, while KDA is better in gender prediction. Handwriting produced by the same person produce better results for gender prediction unlike for age range and nationality prediction. The KDA show better results for Arabic script hence reliable in UAE and other Arabic countries.

Based on the research two sample of the adult lettering for sex of the writer, their accuracy was better than the possibility and enhanced with practice. In another study, participants not cued for sex of the author gave their judgment as coded female and male scripts to be varying concerning qualities like carefulness, regularity, neatness, and speed of writing. The participant prompted for gender also based on the judgment for their stylistic features which included the slope and the roundness which showed carefulness against confidence. Individuals who prompted for writer's gender became affected by gender stereotype leading to incorrect data.

Several methodologies have come across from different forensic examiners who study the variation of letters focusing on the sex of the writer. The female hand writing is a more rounded compared to males. Sex dependent characteristic in handwriting includes determination of the ability of both skilled and unskilled person to come up with the writer's sex. Previously a study shows variation in males and females handwriting that facilitate forensic analysis. Data samples obtained from a hundred two hundred females and males of equal number show the difference in feminine and masculine writing.

The contribution of the writer help in gathering statistical information where the analysis showed rounded open counter parts in vowels, curves and gentle hooks which are of consistent size, inter-word space, slant, and angle became nicely upward flourished. These qualities get mostly found feminine handwriting. However, in masculine writing, there were observations of inconsistent letter size, inter-word space, slant which were cramped and tiny in their letters. Their letters would start with flourishes straight stems and narrow corners. These results show that given a large number of suspected people and information the level of accuracy and certainty would emerge making it possible to identify the suspect sex and age hence leading to his or her capture and therefore, reducing the number of unpunished criminals.

The Limitations process of handwriting analysis.

- Through simulation, forgery can be undetectable.
- There is difficulty in comparing lower case and upper case letters.
- The excellence of the suspect's note determines the worth of the comparison analysis, though it is hard to get one.
- A person under the influence of illness, drugs or the exhaustion can interfere with the writing.

The analysis has a major shortcoming of it being subjective meaning that it focuses on scientific community acceptance and the quote evidence which is undermining. Recently, analyst undergoing training to become more standardized and developed in their procedures. It is gaining the recognition more and more as it is becoming reproducible, and scientifically reviewable. Through the Forensic system, which allows experts to scan the written document and enhance digitalization in the comparison process may increase the process leading to its acceptance in the court.

Forgery

Through falsification of a material such as the manuscript or a historic letter and especially letters written by celebrities, duplication can exist. An important figure and famous theory or a recognized writer can get forged due to the insight it provides. Qualified forgers try to make a copy of the original document such that the material used is similar to that of the original document. Forgers do this by gathering old books, papers the cut them for their forgery activity (Eneh, 2010). Due to the change of paper, marking forgers use the aged paper to pass little evaluation test. The inks they use is the mixer of the links from the document they want to duplicate. Handwriting styles and tools become treated to make them look aged. Some chemical application, when put in the paper, indicates the age and the ink.

Various methods can be used to imitate document for examples use of computer and printers. Traced forgery is a kind of simulation said to undergo detection by the handwriting examiner. Signature forgery is hard to detect, unlike the handwriting. Tracing establishes familiarity of the letter, direction, and shape. It helps children to master the difficulties involved in manipulating writing instrument. Nevertheless, forgers carefully trace the written line creating a copy that resembles the original work regarding letter forms, size, spaces and other features that may be strange to the writer.

Traced simulation is similar to perpetrating forgery though rarely encountered. Recognition of the traced copy is problematic for it is almost perfect (Kore & Apte, 2012). If a victim exemplars show poor writing skills such that the normal range of variation, for example, irregular lifts, pen speed, and retouches are a poor chance of forgery increases. Reasons behind fraud include the inability to

determine presence of forgers, physical and mental stress forgers go through while tracing and finally, the tracing process itself is risky. Characteristic of determined writing include;

Regenerated line quality; forgers may at the time have poor line quality due to their failure to rhyme the document with the original document. The lines leave evidence that is then identified by the investigators. The forger's failure and ignorance to use quality line stroke ends and order results in lack of smoothness in the ink line hence capture.

Speed and pressure variation; traced signature and original signatures can vary if the speed and pressure used in making the writing similar. The degree difference of the pressure applied to the writing instrument result to the tracing faster than when the pressure applied is light. Time taken by the owner to sign their name is around 2-5 seconds. By use of the computer, the time of writing the signature by the forger is traceable. Traced signature will often differ from the actual writing by showing the visible signs of being produced slower than usual and applying more pressure.

Retouching and overwriting; a traced forgery tend to get repaired more often than any other type. Some retouching becomes involved while overwriting will be carelessly done. In this cases, patching and repairing is often made by the writer when the inline is moving towards the opposite direction is not the case in forgery.

Pen lifting; a traced writing will indicate its written line that there are a pause and pen lifting before continued fraud. In cases where there is an interruption, and then a resultant continuous flow of writing is genuinely observed .numerous pen lift in the questioned document may be an indication of traced forgery.

Blunt ends; High use of strokes with blunt ends occur in the determined signature. They assume a clubbed outlook although a fishtail shape may appear occasionally. Blunt ends occur on every stroke often and therefore a reliable indicator of forgery.

Tremor; a masked deterioration exhibition takes place in the writing line in the form of the challenge particularly when trace fraud occurs. These tremors are only visible when there is the use of a magnifying device such as a lens.

Technique for gathering handwriting specimen

The characteristics of the collected items become compared against the known standard. The investigator gathers enough samples for comparison purposes. Factors such as previous crowding and alteration, the presence of the eraser noticeable signature difference, noticeable handwriting differences as well as distinct ink usage in obtaining the necessary specimen required for individualization purposes. The explanation is as follows;

Availability of remarkable eraser

By erasing legal document one can get charged with forgery. Erasing cheque show some deceiving acts. By using mechanical or chemical method erasing can destroy handwriting partially or permanently resulting in distortion.

Presence of alteration and apparent crowding

The factor contributes to cheating in the document and the person caught after forensic investigation gets convicted of fraud, uttering or forgery. Investigators can determine the deceit regarding omissions, addition, easer or changing the meaning of the words.

Identifiable handwriting differences

The factor affects the normal subconscious pattern that exhibits the natural habit of writing. Sometimes it's hard to determine the suspect script used in the differing document that has undergone misrepresentation. In case of signatures forgery testifying would be hard especially in the court of law.

Noticeable signature differences

A signature is a product of the brain and is habitual. No single name can be similar to the other. Sometimes names contain elements that are not present in handwriting because they get written faster than writing due to their little text content. Where the signature element conquers with all the items in the comparison specimen, the agreement is that the name come from the same person.

Use of different inks

Different inks show distinct feature which under certain circumstances tell the investigator that the material used is evidence of alteration. The chemical composition of the ink is easily identifiable especially if different inks write the cheque. Ink difference can be distinguishable due to density, serials and color difference.

Identification categories

When carrying out an investigation, there is always one aim which is to find out someone or something. Identification of a criminal is crucial based on the fingerprint which is the most reliable method of identification. Other ways of identifying a suspect include the use of photos, unique qualities and documentation there exist varieties of identification which include: action identification, situation identification, victim identification, imprint identification, witness identification, cumulative identification, culprit identification and origin identification. Researchers do not concentrate on location identification for it refers to the acting discovery hence it is not under research discussion because it claims to acquire crime elements.

On the other hand, imprint discovery aims at achieving individualism by comparing controlled and disputed marks of an object. Victim identification focus on a person who has become affected by fraud. The victim may have the required information concerning the suspect especially from whom the document got received. In analyzing the complaint from the victim, they must include the note or the cheque wrote out by the suspect. This bank record links the suspect to the fraud and the transaction made and also the person who accepted the bank log. Contrary, if the cheque got stolen the accountant can identify the individual.

Witness identification involves getting the right person who was present during the act and can, therefore, provide a statement. The bank teller is a good witness in this case who can identify the suspect. The cashier passes over the cheque involved in fraud to the investigator hence aiding in the identification of the criminal. The fingerprint examined in the bank note could show who the suspect is as well as reveal other possible witnesses.

Origin identification focuses on organic and inorganic materials that tell whether the disputed sample and the specimen under investigation has a relationship. For example, if the cheque is the duplicate it may help in determining the printer's ink used on the bank statement. After locating the printer, connections can occur between the printer and the suspect computer. The finding could help in realizing the printer used to produce the cheque.

Action identification is discovering the behavior of human directly related to a crime. It contains crucial crime elements. Many criminals have a kind of trait that link them to their criminal conduct. Real evidence can aid in discovering characteristic that is if the same syndicate gets used in the crime. Culprit identification refers to positive recognition of a person without consideration of the unlawful participation in the offense. Determination of his identity is of great importance for the detection and clarification of the crime scenario. The collection of this facts determine whether the offense is the crux in the case of the offender. Both direct and indirect identification procedures can become used in the investigation. Identification of fingerprint at the crime scene is of no use until it becomes matched with the particular person. The characteristic of an ideal discovery medium is unique, invariable, classifiable, universal and easily reproducible.

Cumulative identification is where there is a collective contribution of various specialists in a crime situation. All categories identified during the forensic investigation assist in gathering enough evidence acceptable by the law court. Individualization process amount to enough proof Providence to prove a person guilty of the criminal activity in the court. Fraud is a deceit which aims at selfish gains with the intention to mislead a victim into agreeing to something that is untrue without his consent. Through fraud, various elements can be identified which agree with its definition and may include intention, prejudice, misrepresentation, and unlawfulness.

Misrepresentation is when a false message gets conveyed by a person to another. It is a distortion of the truth: a lie. In all crimes, there is intentional human conduct which reveals itself in either doing something or failing to do it. The first criteria the investigator

determine is whether there was a commission or an omission in the action of the suspect. Forgery, fraud, and altering are all misrepresentation acts.

Prejudice involves telling a lie to cause harm to another. It is also called potential bias for its result to fraud after misunderstanding result. Unlawfulness represents the violation of statuary donation which either prohibits or prescribes an action. It is most difficult to know the action or omission that would be unlawful since there are no hard rules as for how one can be unlawful. Finally, intention implies that both representation and prejudice recognition. An individual must have an intention to cheat and cause another person to act to his prejudice by misrepresenting him on the grounds.

On the contrary, the evidence is a truthful information based on the facts. Physical proof is a concern of material rather than the human being which is recognizable and or visible like any objects or print. Real evidence is measurable, analyzable and presentable in the court as a physical object. Materials used as real evidence include the photograph, weapons, handwriting and finger prints. Physical evidence (PE) is any material present at the crime scene which falls into two categories: testimonial and physical proof.

The investigator has a role to collect all the available evidence at the crime scene. The gathered information integrity get protected by the experts. Real proof can be of any form be it a large building or a small piece of fiber. The evidence value is as follow:

a) PE can testify of a committed crime.

b) The evidence can help in fighting for the innocent.

c) It can support the testimony of the victim.

d) Suspect evicted by proof can confess his mistake.

e) They are reliable.

f) It is crucial in determining court decisions.

g) It can place the crime scene in contact with the suspect.

Therefore, the crime examination aims to show the suspect the crime he committed, gathering the proof, individualize the offender, and connect the criminal with the consequent crime thus he gets arrested. Also, there is tracing of the possible stolen property. Finally, the culprit gets involved with prosecution consequences. Here, the experts base their investigation on identifying the category important in the crime. The research efforts focus more on the known and unknown criminal. Concentrating on the unknown criminal helps one to focus on the trace proof or the eyewitness.

The offender examination requires the experts to have particular skills and knowledge on how to collect the evidence presented before the court of law. For successful prosecution and conviction processes, the crime management in gathering the proof become enhanced thus the culprit face the law. For this process to take place all the essential requirements concerning the integrity of the collected sample get attached to the investigation. Finally, the experts should ensure that the examination gets successfully done within the law factors.

VII.Conclusion

The best way to discover one's personality is through their handwriting which is distinct. Through graphology, one can find themselves after their writing become analyzed. Analyzing handwriting through scientific means help experts to identify a criminal based on the novel features. Known document traced in a crime scene can be carefully collected and take to the lab for analysis. It is through this analysis that hints of sex and age become revealed. Forensic analysis plays a key role in determination forgeries and disguises through comparison of the suspect handwriting and other evidence. The importance of identifying deception does not become underestimated because of the deceit, intent and lack of authority involved.

The experts improve the accuracy of their work when more copies of evidence are available. The texts help the investigators to dig deep to find the repelling factors among the documents. The similarity, in this case, is rarely considered, therefore, the more the

difference between the papers the better the accuracy. Given that there is minimal distinction after analyzing the article it is possible that the same person wrote the document. If not then, the chances are that the suspect is copying the handwriting, or he is not guilty. The use of random forest and kernel discriminant analysis the experts can be able to determine the gender, nationality, handedness and age range of known and unknown suspect hence an appropriate method.

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