CHAPTER 1

INTRODUCTION

During the course of our lives, we sign our name many thousands of times on checks, applications for loans, marriage licenses the list is endless. People in positions of authority can certify the existence of a person with a signature on a birth certificate, or end a life with a signature on a death warrant. Signatures have been applied in much the same way since ancient times by scribing one's own name. Within the past few years cryptography has made a new way to affix signatures practical. The legal and business communities are rushing to adopt these new cryptographic signature techniques to replace handwritten signatures - but how analogous are handwritten and digital signatures? This paper will explore the similarities and differences between traditional and cryptographic signatures from a technical, legal and practical perspective.

The traditional function of a signature is to permanently affix to a document a person's uniquely personal undeniable self identification as physical evidence of that person's personal witness and certification of the content of all, or a specified part, of the document. For example, the role of a signature in many consumer contracts is not solely to provide evidence of the identity of the contracting party, but also to provide evidence of deliberation and informed consent. In many countries, signatures may be witnessed and recorded in the presence of a notary public to carry additional legal force. On legal documents, an illiterate signatory can make a "mark" so long as the document is countersigned by a literate witness. In some countries, illiterate people place a thumbprint on legal documents in lieu of a written signature. The term signature is generally understood to mean the

signing of a written document with one's own hand. However, it is not critical that a signature actually be written by hand for it to be legally valid. It may, for example, be typewritten, engraved, or stamped. The purpose of a signature is to authenticate a writing, or provide notice of its source and to bind the individual signing the writing by the provisions contained in the document. Because a signature can obligate a party to terms of a contract or verify that the person intended to make a last will and testament, the law has developed rules that govern what constitutes a legally valid signature. The Internet and other forms of telecommunication have created the need to transact legally binding agreements electronically. Almost all states have passed laws that recognize the validity of "digital signatures. When an instrument must be signed it is ordinarily adequate if the signature is made in any commonly used manner. Variations between the signature and the name appearing in the body of the instrument do not automatically invalidate the instrument. In the absence of a statutory prohibition, an individual can use any character, symbol, figure, or designation he wishes to adopt as a signature, and if he uses it as a substitute for his name, he is bound by it. For example, if a contract refers to "William Jones" but Jones signs his name "Bill Jones," the contract is still enforceable against him. An individual can also use a fictitious name or the name of a business firm. A signature might also be adequate to validate an instrument even if it is virtually illegible. The entire name does not have to be written, and the inclusion of a middle name is not significant.

An individual satisfies the signing requirement when someone who has been duly authorized to sign for him does so. In the event a statute mandates an instrument be signed in person, the signature must be made in the signer's own hand or at his request and in his presence by another individual. In a situation where an individual intends to sign as a witness but instead inadvertently signs the

instrument in the place where the principal is to sign, the fact that he should have signed as a witness can be shown. Conversely when a signer intends to sign as a principal but instead signs in the place for a witness, that fact can also be shown. In situations that do not require a more complete signature, an instrument can be properly signed when the initial letter or letters of the given name or names are used together with the surname when only the full surname is used when only the given name is used or even when only the initials are used a signature can be written by the hand of the purported signer, either through the signer's unaided efforts or with the aid of another individual who guides the signer's pen or pencil. In cases when the maker's hand is guided or steadied, the signature is the maker's act, not the act of the assisting individual. A signature can generally be made by one individual for another in his presence and at his direction, or with his assent, unless prohibited by statute. A signature that is made in this manner is valid, and the individual writing the name is regarded merely as an instrument through which the party whose signature is written exercises personal discretion and acts for himself. Ordinarily a signature can be affixed in a number of different ways. It can be hand written, printed, stamped, typewritten, engraved, or photographed. This allows, for example, a business to issue its payroll checks with the signature of its financial officer stamped rather than handwritten.

The handwritten signature is one of the most accepted personal authentication methods and it has been used over the past 2000 years. As a behavioural biometric trait, one of the key characteristics of the signature is its high intra-person variability. The high variability between samples of the signature of the same person together with the ability of people to perform skilled forgeries make signature recognition a great challenge. Historically, signature recognition is made by Forensic Document Examiners (FDE) who have developed well-

established protocols and methods to analyse the authenticity of a query signature. This is a time consuming and manual task which depends on the FDE training and experience. Therefore, the applications are limited to authentications without requirements of real time response (forensics and offline scenarios).

An electronic signature, or e-signature, refers to data in electronic form, which is logically associated with other data in electronic form and which is used by the signatory to sign. This type of signature provides the same legal standing as a handwritten signature as long as it adheres to the requirements of the specific regulation it was created under .Electronic signatures are a legal concept distinct from digital signatures, a cryptographic mechanism often used to implement electronic signatures. While an electronic signature can be as simple as a name entered in an electronic document, digital signatures are increasingly used in e-commerce and in regulatory filings to implement electronic signatures in a cryptographically protected way. Standardization agencies like NIST or ETSI provide standards for their implementation. The concept itself is not new, with common law jurisdictions having recognized telegraph signatures as far back as the mid-19th century and faxed signatures since the 1980s.

Electronic signatures are popular because they are easy to use. Customers can sign documents online with a click of the mouse or by using their fingers to trace a handwritten signature onto a document.The downfall of electronic signatures is that they aren't regulated like digital signatures are. It's up to each vendor to make their own standards, and you have to take their word for it when they say their signatures are secure. In fact, electronic signatures don't have the secure coding that digital signatures have. That technology is what links the signature to the signer's identity and to the time the document was signed. Essentially, electronic signatures are an image placed on the document, but they can't show if someone

tampers with the document after it is signed. Another drawback of electronic signatures is the fact that many vendors require you to check back with them if you'd like to know if your document has been tampered with. That means if you decide to change to a different vendor, you could lose those signatures that are stored on the vendor's server. At SIGNiX, we combine all of the security of digital signatures with the convenience of electronic signatures using our patented cloud-based technology. To learn more about how we were able to do this, check out the video below.

A digital signature is a type of electronic signature that offers more security than a traditional electronic signature. When you sign a document with a digital signature, the signature links a "fingerprint" of the document to your identity. Then that information is permanently embedded into the document, and the document will show if someone comes in and tries to tamper with it after you've signed it.

Because that information is embedded in the document, you don't need to check back with the vendor if you want to verify that the signature is still secure. That's a big benefit if you don't want to be tied down to one vendor over the life of your documents. On top of that, more countries around the world accept digital signatures because they comply with international standards for security.

CHAPTER 2

LITERATURE REVIEW

B.M. Herbst(2006)**Off-Line Signature Verification: A Comparison between Human and Machine Performance**When a large number of documents, e.g. bank cheques, have to be authenticated in a limited time, the manual verification of, say the authors' signatures, is often unrealistic. This led to the development of a wide range of automatic off-line signature verification systems. However, the value of such a system is rarely demonstrated by conducting a subjective test. We recently developed a novel off-line signature verification system that uses features that are based on the calculation of the Radon transform (RT) of a signature image. Each writer's signature is subsequently represented by a hidden Markov model (HMM). This paper is an extension of and illustrates the value of our system by showing that it outperforms a typical human being.

LaVelle (2007) Forensic Analysis of Electronic Signatures.The electronic capture of handwritten signatures presents novel opportunities and challenges in forensic signature analysis. Electronic signatures that capture dynamic movement allow for the analysis oftemporal handwriting characteristics, characteristics not previously possible in the examination of traditional pen-and-paper signatures.

Srivastava, A(2009)**Electronic signatures and security issues: An empirical study.** Security concerns with regard to the use of electronic signatures in the electronic environment seem to represent a potential barrier to their usage. This paper presents an empirical study that examines businesses' perceived security concerns with the use of the electronic signature technology for executing contracts and commercial transactions and whether such issues represent a disincentive for their usage. The findings of the study reveal that there are significant security concerns in the business community with regard to the use of electronic signatures. However, such perceptions seem to be primarily driven by

a lack of awareness and understanding. Advising prospective users of electronic signatures about the kind of safeguards that could be put in place to minimise risks associated with their usage can be a useful step towards overcoming their fears and hesitance.

Javier Galbally(2014) **Recent developments in the study of rapid human movements with the kinematic theory:** Applications to handwriting and signature synthesis.Human movement modeling can be of great interest for the design of pattern recognition systems relying on the understanding of the fine motor control (such as on-line handwriting recognition or signature verification) as well as for the development of intelligent systems involving in a way or another the processing of human movements. In this paper, we briefly list the different models that have been proposed in order to characterize the handwriting process and focus on a representation involving a vectorial summation of lognormal functions: the Sigma–lognormal model. Then, from a practical perspective, we describe a new stroke extraction algorithm suitable for the reverse engineering of handwriting signals. In the following section it is shown how the resulting representation can be used to study the writer and signer variability. We then report on two joint projects dealing with the automatic generation of synthetic specimens for the creation of large databases. The first application concerns the automatic generation of totally synthetic signature specimens for the training and evaluation of verification performances of automatic signature recognition systems. The second application deals with the synthesis of handwritten gestures for speeding up the learning process in customizable on-line recognition systems to be integrated in electronic pen pads.

Robertson, J et.al (2015) **A feature based comparison of pen and swipe based signature characteristics.** Dynamic Signature Verification (DSV) is a biometric

modality that identifies anatomical and behavioral characteristics when an individual signs their name. Conventionally signature data has been captured using pen/tablet apparatus.To explore the potential of employing DSV techniques when a user signs or swipes with their finger, we report a study to correlate pen and finger generated features. Investigating the stability and correlation between a set of characteristic features recorded in participant's signatures and touch-based swipe gestures, a statistical analysis was conducted to assess consistency between capture scenarios.The results indicate that there is a range of static and dynamic features such as the rate of jerk, size, duration and the distance the pen traveled that can lead to interoperability between these two systems for input methods for use within a potential biometric context. It can be concluded that this data indicates that a general principle is that the same underlying constructional mechanisms are evident.

DerlinMorocho(2016) et.al **Signature recognition: establishing human baseline performance via crowdsourcing**. This work explores crowdsourcing for the establishment of human baseline performance on signature recognition. We present five experiments according to three different scenarios in which laymen, people without Forensic Document Examiner experience, have to decide about the authenticity of a given signature. The scenarios include single comparisons between one genuine sample and one unlabelled sample based on image, video or time sequences and comparisons with multiple training and test sets. The human performance obtained varies from 7% to 80% depending of the scenario and the results suggest the large potential of these collaborative platforms and encourage to further research on this area.

Sanchez-Reillo, R. (2016) **Signature analysis in the context of mobile devices**. Handwritten signature is one of the oldest means of the human being to both

authenticate him/herself and state that a certain document has been understood and accepted. In the modern world, this biometric modality was translated to the use of peripheral pads that allow the signature to be performed by the user. However, in the recent years, the proliferation of mobile devices with touch screens has paved the path to deploy this biometric modality beyond the limits of a desktop. Bringing this biometric modality to mobile devices open several challenges, being some of them already covered, but some others needing further study. This paper provides an overview of these challenges and point to future research works that can help to the continuous deployment of this biometric modality.

Flynn, W. J et.al (2019)**. The examination of electronic signatures.** Humans have used handwriting as a means of recording their thoughts for more than 4000 years. During that time, we have evolved from scratching cuneiform symbols on clay tablets to "texting" our friends. In more recent times, writing instruments have gone from bird quills, to steel-nibbed pens, to ballpoint and liquid ink pens, to a stylus on electronic signature tablets. Forensic handwriting identification techniques that evolved in the late 19th and early 20th centuries relied on characteristics of the nibbed pens of that era to add "pressure" information to the writing line. The resulting placement and quality of the "shading" in the writing line was a good indication of the speed and potential genuineness or nongenuineness of a writing.

CHAPTER 3

AIM AND OBJECTIVES

AIM

To Compare characteristics of Electronic signatures and Handwritten Signatures.

OBJECTIVE

- To identify the variations in both signature types.
- To know the biometric importance of the signature
- To compare integrity and authenticity of Electronic signatures over Handwritten Signatures.

CHAPTER 4

MATERIALS AND METHODOLOGY

Materials

- Paper
- Pen
- Smart phone having electronic signature

Methodology

Standard and genuine signatures are collected from 10 males and 10 females of age group 20-22. An informed consent is taken from the volunteers/participant for collection of standard signature. Consent includes statement of the project, purpose, procedures and utilization of the signature which are obtained for the project process.

5 handwritten signatures on the paper and 5 Electronic signatures by using an app "Digital Signature" on smart phone are collected from each person for study purpose.

Note: To avoid fraudulent use of Participant signatures by forgers, I have not included collected signature samples in the project work.

About the app:

Name of Mobile Application: Digital Signature

Developer: Track Apps

DIGITAL SIGNATURE: e-signature app, a digital signature software and digital signature solution . Digital signature app can also be called an electronic signature software and e-signature software. Simply add signature and electronic signature with email signature app and best known as name signature and it will do the rest. This is the excellent signature maker and signature creator app and very easy in

many situation such as digital sign, name signature email signature , e-signature and very handy in document signature .

Digital signature software and digital signature app such as digital signature solution electronic signature software and e-signature software is very easy to use as to add sign as digital sign and for digital signature for business

1. Manual Signature Features: First feature of digital signature software (digital signature app) is the manual ways for digital signature solution and digital signature for business. Manual feature provides full control to the signer as a e-signature software best called electronic signature. With this method you don't require to give signature. This is totally digital sign and fit for email signature and e-signature. It is fit for document signature and how to make a signature is also accurate for name signature. Manual signature is amazing for sign documents and signatures with sign easy, signeas and other e sign unlike auto signature. So create signature without any problems with sign pdf and docusign. Sign pdf is easy and document writer is suitable for digital form and for autographer.

2. Auto Signature method: Auto signature option needed very small work to be a signer and document signature and name signature. Whole signatures are made automatically so sign easy without any effort with e sign and create signature and sign pdf and easy document writer and fill the digital form without any effort. docu. signow or sign easy with hellow sign photography signature category is also included in this part and sign maker .

CHAPTER V

RESULTS

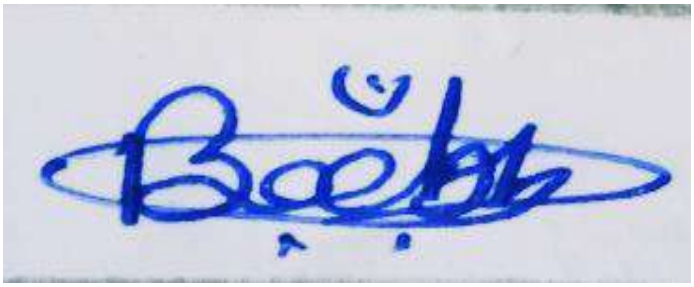
COMPASISON OF SIGNATURE CHARATERSTICS BETWEEN ELECTRONIC SIGNATURE AND HAND WRITTEN SIGNATURE

PATTERN CHARACTERSTICS					
Sl no	SAMPLE	DISSIMILARITY		SIMILARITY	INFERENCE OF SIMILARITY WITHIN ELECTRONIC SIGNATURES
		HANDWRITTEN	ELETRONIC		
1	1	There are many buckles formation and congestion in signature	There is clarity in the buckle formation and clearly visible	Signature forms dots and circular loop is present	2/5
2	2	There is congestion in the sign and having connection of letters	Less congestions and stroke formation more visible	It forms a long base line and beard	3/5
3	3	Having good gap in between letter formation	The base line lies little bit down portion of the main portion	Four small loop found inside the oval of the letter	4/5
4	4	Ending of the letter formation one stroke is formed	The stroke formed is not more visible	Connection are in there stroke and forms four dots	4/5
5	5	Buckles present and connection is not there in the letter	Buckle formed in an irregular manner	Three dots are present and base line having good length	2/5
6	6	Retouching of stroke are present and an hook forms in the end of terminal stroke	The hook form the end of terminal stroke goes upward of the base line	Body of the letters are almost similar	4/5
7	7	Hook is present and a small loop present in the end of base line	Less congested and the is clarity in the body	The end of the terminal stroke not having more variations	3/5
8	8	Congested letter formation and irregularity in base line	Less congested and having good rhythm formation	Two loops are formed and a line goes downward of the base line	3/5
9	9	Continuous stroke and retracing are visible	Three dots are present and end of terminal stroke having loop	No more congested and having circular loop	2/5

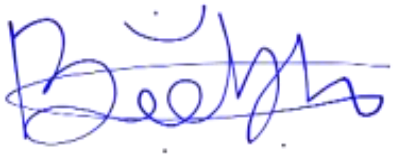
				around the stroke	
10	10	Starting size of letter is different and the end stroke lies in the base line	End stroke lies in the down portion of the base line	Base line starting after the buckle only	2/5
11	11	The letter “S” completed by forming a loop and a single dot present in downward of the baseline	These is no loop forming in the letter “S” and irregular dots are found	An hook is present in the starting terminal and a dot is lies in the downward of the baseline	3/5
12	12	The letter formation are in limited gap	The gap between the strokes are little more	There is no connection strokes and the letter “A” enlarge and form base line	2/5
13	13	Continuous strokes are formed and one line goes down of the baseline	There is no line under the baseline	The starting strokes are form a arch on the sign	2/5
14	14	Two dots are visible in the down portion of baseline and one loop is present in the sign	Two dots are not found and the letter formation is irregular	The starting stroke makes two shoulders. The base line is having more length than the body	3/5
15	15	Discontinuous writing and more clarity. spar present in the starting of writing	There is variations in the loop formation	The body do not touching the base line	3/5
16	16	Gaps present in between the letters and dots present top of “s” letter	Base line having irregularity in formation	Letter formation having more visible clarity	4/5
17	17	Loop present in the starting stroke and two dots are present more clear	Congested letter formation and small variations	Top part of the sign is passing enlarged horizontal line	3/5
18	18	Ending stroke having hook	Ending stroke not having hook	Beard is present and upward of sign one horizontal line is passing	3/5

19	19	More congested and continuous stroke	No more visible in line formations and letters	The base line is little enlarged and two dots are in the end terminal	2/5
20	20	Continuous writing and two dots are present in the down portion of base line	More congested and less visible one	Stroke start with arch and the letters lies in the base line	2/5

Signature sample:



Handwritten Signature



Electronic signature

Comparison of signature in electronic and handwritten

The above mentioned table illustrate dissimilarity and similarities observed in writing stroke pattern on paper and screen. It may not be completely reliable to identify an individuals unique signature. There certain invisible characteristics involved in the signature and those are discussed below.

Characteristics of electronic signature:

Electronic signature can be verified and authorised on the basis of following characteristics.

1:**Biometric movement**

It is the movement right from starting stroke till the ending stroke. It is unique on paper and on screen. This particular characteristics place crucial role in identification of signature electronically. Forgery may not be possible based on this characteristics unless and until the forger knows exact movements of the writer

2: **Pattern analysis**

In above mentioned table, pattern analysis was done extensively which is an part of characteristics of general signature also. The signature is unique because of the pattern, this pattern will be recorded in electronic signature software as standard. Then, it will be utilised as for comparison in every case where signature is collected electronically. Pattern of signature may not be same every time. Little changes in signature are omitted due to human habit. There are certain pattern recognition algorithms used for analysis of human writing movement and hand movement. It will help signature identification.

3:**Biometric pressure**

In every signature and handwriting there is an unique pressure involved which may help and can be measured particularly for electronic signature. Factors like posture, bodily movement, health and circumstance may influence pressure of signature and handwriting. Hence pressure can be a reliable and circumstantial characteristic for authentication of signature.

4: **Speed**

Speed can vary on paper and screen for electronic signature. Signature is done on paper using a writing instrument like pen, pencil, sketch etc. But in case of electronic signature finger and styles are used. Speed is also an individual characteristics which can determine authenticity. But it will be affected by the writing instrument. The proper signature can be obtained only with usual and normal speed involved signing and this can be achieved partially on electronic signature.

5: **Signature Line Coordination**

Signature line coordination studied in two dimensional scaleas per “X” and “Y” axis on a plane. Electronic signature can implement range of strokes calculation based on length, curve, thickness of line etc. On graphical representation of “X” and “Y” axis this particular characteristics can be utilized only by electronic device for electronic signature and similar to pattern.

CONCLUSION

In the present study it is clearly observed that there are lot of differences in handwritten signature and electronic signature. While doing handwritten signature the person is more comfortable to put the signature on the paper holding a writing instrument. So he/she can put it in a very perfect manner and we can observe the rhythmic and regular details of the signature. But in case of electronic signature the screen may not capture the same characteristics like same speed, length and width

There are certain qualities to be indulged in electronic signature to avoid imperfection in the signature. Retouching, Congestion and Complexity are the factors to be eliminated. Which will make more perfection and we can identify the signature in a proper manner. This will enable to compare it with handwritten signature in a proper way.

Mainly electronic signature function is to do attaching with any kind of documents for verification. Now this kind of document are very normal. The electronic signature main function is to do the authenticity and security.

Whatever the electronic signature are used widely also it can be forged or misused by other people. So we provide more advanced level of electronic signature which can't be forged or misused. To avoid this kind of misuse related to electronic signatures, Biometric Pattern Recognition, Encryption of Pixel data and digital signing option are already available in the digital market. Hence, Awareness and Cost efficiency should be focused on for wide public usage.

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