

2nd International Workshop on Automated Forensic Handwriting Analysis (AFHA) 2013

22-23 August 2013, Washington DC, USA



AFHA 2013

ONLINE PROCEEDINGS

PREFACE

Handwriting is considered as a representative of human behavior and characteristics for centuries. With the evolution of modern computing technologies, researchers have moved towards the automated analysis of handwriting. This shift has been reinforced by the interest various industries have in this field. One of the most important applications of automated handwriting analysis systems is in forensic environments. Until now, most of the forensic handwriting analysis cases are solved without actual application of automated systems. This is because there is an ever increasing gap between the demands of Forensic Handwriting Experts (FHEs) and the computer science community. Actually the underlying issue is the incapability of most of the state-of-the-art automatic handwriting examination systems to be directly applicable to the forensic cases. This is because the computer science community in general has moved by considering the cases which are either trivial w.r.t. forensic situations or not considered the needs of FHEs. Thus, there is a great demand to bring the forensic experts and the computer science experts under one roof. The 2nd International Workshop and Tutorial on Automated Forensic Handwriting Analysis (AFHA) 2013, like its predecessor AFHA 2011, serves this purpose.

The AFHA 2013 takes place on 22-23 August 2013, in Washington DC, USA, and is organized as a two-day combined workshop and tutorial covering a diverse range of topics influencing handwriting analysis in the forensic science and in computer science (particularly, in pattern recognition).

On the first day, an introductory tutorial on forensic handwriting examination and automatic handwriting/signature analysis is given. This includes a description of the forensics point of view and examples of real casework as well as a summary of important approaches in the area of automated handwriting examination. The major topics include: how forensic experts make comparisons (similarities versus differences, subjectivity, and bias), natural variation, line quality, quality versus quantity; what forensic experts need from the document analysis community; what the document analysis community needs to understand about FHEs work; existing systems and system problems; application of the Bayesian approach to forensic evidence evaluation (i.e. using the Likelihood Ratios a measure of the strength of evidence), and reporting by means of a verbal conclusion scale. The state-of-the-art of automatic handwriting/signature analysis systems is also focused where the emphasis is on the internal working of these systems along with the future directions in this regard. The purpose is to familiarize the forensic experts about working of automatic systems.

On the second day, the workshop is organized where researchers from handwriting examination and pattern recognition communities present their novel researches. This volume contains the proceedings of the AFHA 2013 workshop. Thirteen submissions were received and after a single-blind-peer review process, ten papers were accepted for this volume.

The first paper, '*Some Observations on Handwriting from a Motor Learning Perspective*' discusses the dynamics of signatures in the light of recent findings in motor learning, according to which a signature is a highly automated motor task and, as such, it is stored in the brain as both a trajectory plan and a motor plan. It conjectures that such a stored representation does not necessarily include the entire signature, but can be limited to only parts of it, those that have been learned better and therefore are executed more automatically than others.

The second paper, '*Offline Handwriting Acquisition under Controlled and Uncontrolled Conditions*' discusses the offline handwriting acquisition under controlled and uncontrolled conditions for research purposes. The paper emphasizes that for forensic purposes, it is preferred to start building databases with forensically relevant data. This is because handwriting samples that make

up the current publicly available databases have all been collected under controlled conditions.

The third paper '*Oriented Local Binary Patterns for Writer Identification*' presents an oriented texture feature set, based on local binary patterns (LBP), and apply it to the problem of offline writer identification using the ICDAR 2011 and ICHFR 2012 writer identification contest datasets.

The fourth paper '*Chinese Handwritten Writer Identification based on Structure Features and Extreme Learning Machine*' proposes an approach for writer identification of Chinese handwriting using Chinese character structure features (CSF) and extreme learning machine (ELM). To extract the features embedded in Chinese handwriting characters, special structures have been explored according to the trait of Chinese language.

The fifth paper '*Dissimilarity Representation for Handwritten Signature Verification*' discusses the dissimilarity representation (DR) approach where proximity among patterns constitute the classification space. The paper provide various scenarios where similar concept has been applied by forensic Questioned Document Examination (QDE) experts, when proximity between questioned signatures and a set of templates lead to the authentication decision.

The sixth paper '*Multi-script Off-line Signature Verification: A Two Stage Approach*' presents a technique for off-line English, Hindi (Devnagari), and Bangla (Bengali) signature verification by initially identifying the script type and then applying verification. This paper highlights that better results could be achieved when the script is identified in advance.

The seventh paper '*Off-Line Signature Verification based on Ordered Grid Features: An Evaluation*' presents and evaluates an offline signature modeling which attempts to advance a grid based feature extraction method uniting it with the use of an ordered power set. More specifically, this work represents the pixel distribution of the signature trace by modeling specific predetermined paths having Chebyshev distance of the two, as being members of alphabet subsets-events.

The eighth paper '*Towards Automated Hyper-spectral Document Image Analysis*' provides an overview of the applications of hyper-spectral imaging with focus on solving pattern recognition problems, especially handwriting analysis and signature verification.

The ninth paper '*Fusing Modalities in Forensic Identification with Score Discretization*' proposes a method of score fusion based on discretization. It is evaluated considering the signatures and fingerprints.

The tenth paper '*Joint Glossary of Forensic Document Examination and Pattern Recognition*' introduces an open scientific glossary, based on the MediaWiki engine, to the forensic examination and pattern recognition communities. The purpose is to enable the development of a shared conceptualization among the two communities.

We would like to thank the authors for their paper submission, our program committee members for their reviews and active participation in various activities concerning tutorial and workshop, and the AFHA 2013 workshop chairs for their advice and guidance throughout the endeavor.

The AFHA 2013 PC-chairs,
August 2013.

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Joint Glossary of Forensic Document Examination and Pattern Recognition

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Abstract—In this paper we introduce an open, scientific glossary which uses MediaWiki engine to the forensic examiner and pattern recognition scientific communities. Besides our aim to find editors from these communities who contribute to extend the glossary and make it as complete as possible, we would like to translate the terms from English to other languages, e.g. Portuguese, German, Chinese, Japanese, Arabian. The contribution can be started with translating the existing words at the glossary. The second part of our work when the glossary become be more completed, will consist into create the very understanding and useful glossary.

I. INTRODUCTION

In the last few years there were more and more communication and joint research between the forensic examiners and pattern recognition scientists. These two communities can efficiently work together, if they understand the terms from both sciences. We have seen and heard on meetings, conferences, workshops, and during discussions it is a necessity to have a useful, extendable glossary, and dictionary which helps the common work.

Our aim is to create a glossary and a dictionary with the important terms of the forensic science for the forensic document examiners and pattern recognition experts in different languages. We are considering even the different expressions among countries who share the same language in order to obtain a better understanding into our fields no matter where we are from. Thinking and hoping this work will be a useful tool for both: the forensic and pattern recognition communities.

The long name of the glossary is *Glossary of Forensic Document Examination and Pattern Recognition* and the short name is GoFDER. The site is available on the <http://projects.dfki.uni-kl.de/gofder/index.php> URL. Figure 1 shows the logo of the glossary which depicts an important tool of the forensic scientist.

A. Related work

An offline glossary from 1999 is [2] which integrates first time in publishing terms from forensic science. The Forensic Science Central is a great contribution with links and forum, but its own glossary [3] contains only a small portion of definition, there is no dictionary and it is not extendible. Similar holds for the website of ThinkQuest [4], in addition there are less terms and the terms there were not described by experts,

the reference marked on the page is only Google search. The multilingua lexicon of European Network of Forensic Science Institutes (ENFSI) is a great contribution created by several forensic institute, founded in 1999. It contains several words in many languages, but it is only a dictionary, without explanation, descriptions.

B. Authors

The first author Inés Rosa Baldatti is a forensic document examiner, analyst of Payment Systems at the Central Bank of Argentina Republic. The second author Erika Griechisch is a PhD student at the University of Szeged (Institute of Informatics), her topic is online signature verification. Further authors are every colleague who would like to contribute.

1) *Beginning*: The authors met at First International Workshop on Automated Forensic Handwriting Analysis (AFHA) in 2011, Beijing, China. In that opportunity it was clear the necessity to get a good understanding and a fluid contact among professionals worldwide. So, we decide to make this work, that takes a long time and dedication, and responsibility.

2) *Creating*: We read papers and books and websites, and extract the terms from them keeping the meaning.

II. TECHNICAL BACKGROUND

Nowadays a glossary or dictionary which is available only in printed version is not really useful. An online glossary is more useful than a printed one and it can be easily printed if it is necessary. Several criteria should meet, which are feasible only if the glossary is an online one.



Fig. 1. The logo of the project

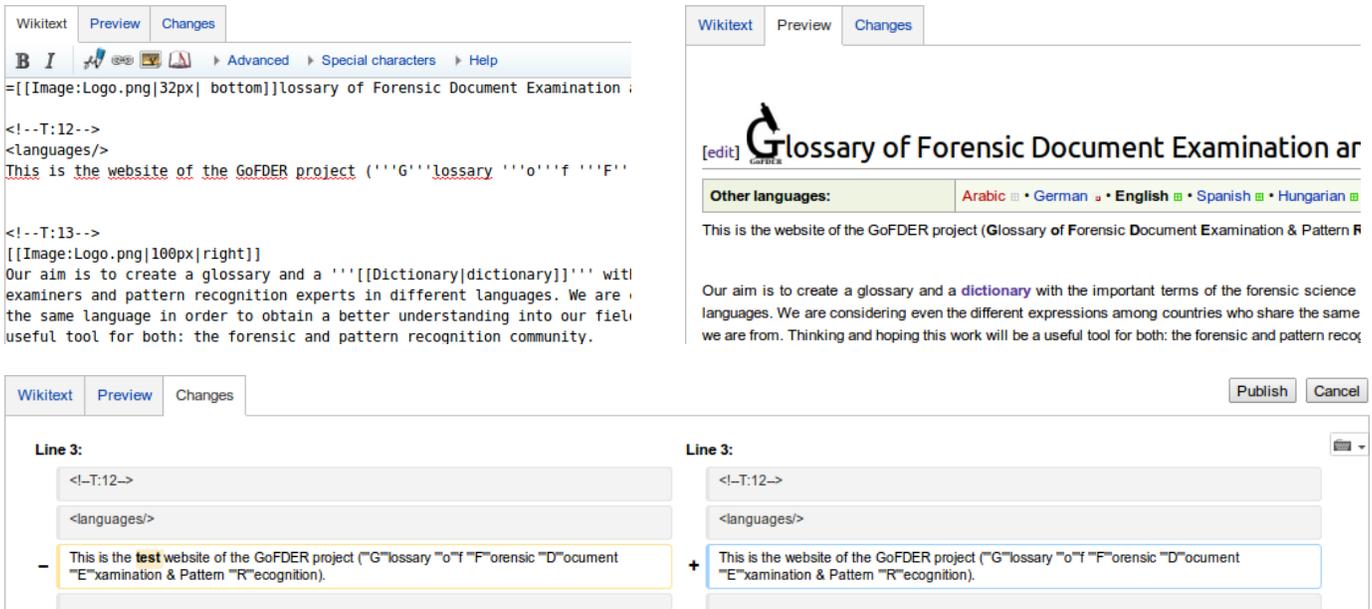


Fig. 2. WikiEditor: WikiText and Preview (above), Changes (below)

The most important criterion is the expandability of the glossary. There will be always terms which can be added, not necessary because there incompleteness of the glossary itself rather the expansion of the scientist. Regarding the expansion, it is much easier to correct errors in an existing online website than a book.

Other consideration was the possibility of localization of the glossary. We know for the translation part it is necessary to be clean and easy otherwise we can expect only few translators.

In this section we introduce and describe the MediaWiki package and its extensions which were most suitable for our purposes.

A. MediaWiki

MediaWiki (MW) is a versatile package, written in PHP and originally developed for use on Wikipedia since 2002. It is very widespread, well-documented, can handle any kind of media easily (links, images, videos, etc), moreover it is open-source which makes it easier to discover and fix any kind of bugs. The MediaWiki package quite flexible and further functionalities can be easily integrated to a basic MediaWiki website.

MediaWiki uses a markup language called *wikitext* to use basic formatting so the users without knowledge of HTML can edit the pages easily. We added the WikiEditor extension to the GoFDER website, which allows the users to see 3 different view during the editing. The first one is the plain wikitext, the second is a preview, the third one shows the differences between the previous version of the page and the current (edited) version. Thus if someone is new in wikitext markup language, s/he can simply check the Preview before submission, see Figure 2.

In order to achieve our goals, to create a multilingual

glossary with dictionary, a basic MediaWiki is not sufficient. Thus we added other extension to improve the efficiency. In the following we describe each of them.

B. Semantical MediaWiki

Semantical MediaWiki (often noted by SMW) is an extension of MediaWiki that helps to search, organise, tag, browse, evaluate and share the wiki's content [8] since 2005.

While a traditional Wikipedia site contains text which is useful and can be processed easily by humans, it is not easy to understand or evaluate for a computers. The Semantical MediaWiki helps to extend a capability of a Wiki site by adding annotations, which makes wiki a collaborative database.

Semantical MediaWiki itself has several extension too, we added the Semantic Glossary to our website, which helps to describe terms with the Terminology page of the wiki. The reader of a page just point to a word with the mouse and if the Terminology page contains that word, it's description will appear in a small box below the word.

C. Translate extension

The Translate extension makes MediaWiki a powerful tool to translate every kind of text. [7]

It runs inside MediaWiki and has many features for translators, however its usage is very simple. After a page is marked with the `<translation>` tag, the extension automatically splits the text between the translation tag to translation units. The arrangement of the translation units can be approved or redefined if it is necessary. According to the default settings each translation unit is one paragraph. After the arrangement of the translation units are saved, the page can be translated via a translation tool. Figure 3 and 4 show two view of a translation page, translators can use which are more convinient for them.

Translation of the wiki page GoFDER.

All Untranslated Outdated Translated ...

<languages/> This is the website of the GoFDER project ("G"lossary "o"f "F"orensic "D"ocument "E"xamination & ...

🕒 Outdated

[/ Edit](#)

☰ List
☰ Page
✓ Proofread

Fig. 3. Translate a page: *List* view

All Outdated Translated Unproofread ...

| | | | |
|---|---|---|-------------|
| 🕒 | <languages/> This is the website of the GoFDER project ("G"lossary "o"f "F"orensic "D"ocument "E"xamination & Pattern "R"ecognition). | <languages/> Ön a "GoFDER" projekt ("G"lossary "o"f "F"orensic "D"ocument "E"xamination & Pattern "R"ecognition) honlapján van. | 👤 / Edit |
|---|---|---|-------------|

☰ List
☰ Page
✓ Proofread

Fig. 4. Translate a page: *Proofread* view

Users can choose the language they intend to translate from a list. On the GoFDER website there is a predefined list on the top of all the translatable webpages which shows the languages we primarily intend to find translators (the first author of this paper is responsible mainly for Spanish translations, the second is about Hungarian). Nevertheless there is no language restrictions, contributors are welcome to translate to any language.

If an original English wikipedia (which is marked for translation) has any changes, on the top of the page there will be a note about that and each unit which is effected will be marked as outdated translation.

III. CONTRIBUTION

Recently (end of May, 2013) the glossary has 20 pages (terms), the dictionary has 561 English words with Spanish translation and some Hungarian translation as well.

A. New terms

We encourage forensic document examiners to extend the glossary and the dictionary as well, comment the recent terms on the discussion pages, ask if something is not clear or complete. We want to keep our glossary professional, so on our wiki site it is not possible to edit or modify pages without registration. After registration and login, users can modify the pages.

B. Translation

We would like to translate the terms from English primarily to Spanish, German and Hungarian. In the same way to increase the dictionary, we plan to add new languages as well. We hope to attain contributors who can create the Portuguese, Chinese, Japanese, Arabian, etc translation.

The translations are available for a page if it is marked for translation. Every registered user can translate sites, but only translation administrators can mark pages for translation and confirm completed translations. If a user creates a page and s/he is member of the Translation group, s/he can mark it for translation. if s/he is not member of this group, she can ask someone from the Translation group.

More details about editing and translating are available on the *Contribution* page of the website.

IV. CONCLUSION

Here we presented the conception and initiation of our work. The technical background of the glossary have been prepared. However we are still open for suggestions and ideas to improve the website. From now on the main part of the project is to add new terms, specify and extend the existing ones, add examples and explanation as many as possible.

We expect as an outcome of our common effort with the contributors that we can provide a useful, up-to-date and beneficial glossary for the scientific community.

ACKNOWLEDGEMENT

The second author was supported by the TÁMOP-4.2.4B/2-11/1-2012-0001 project.

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- [7] Translate Extension (May 2013)
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- [8] Semantic MediaWiki (May 2013), <http://semantic-mediawiki.org>

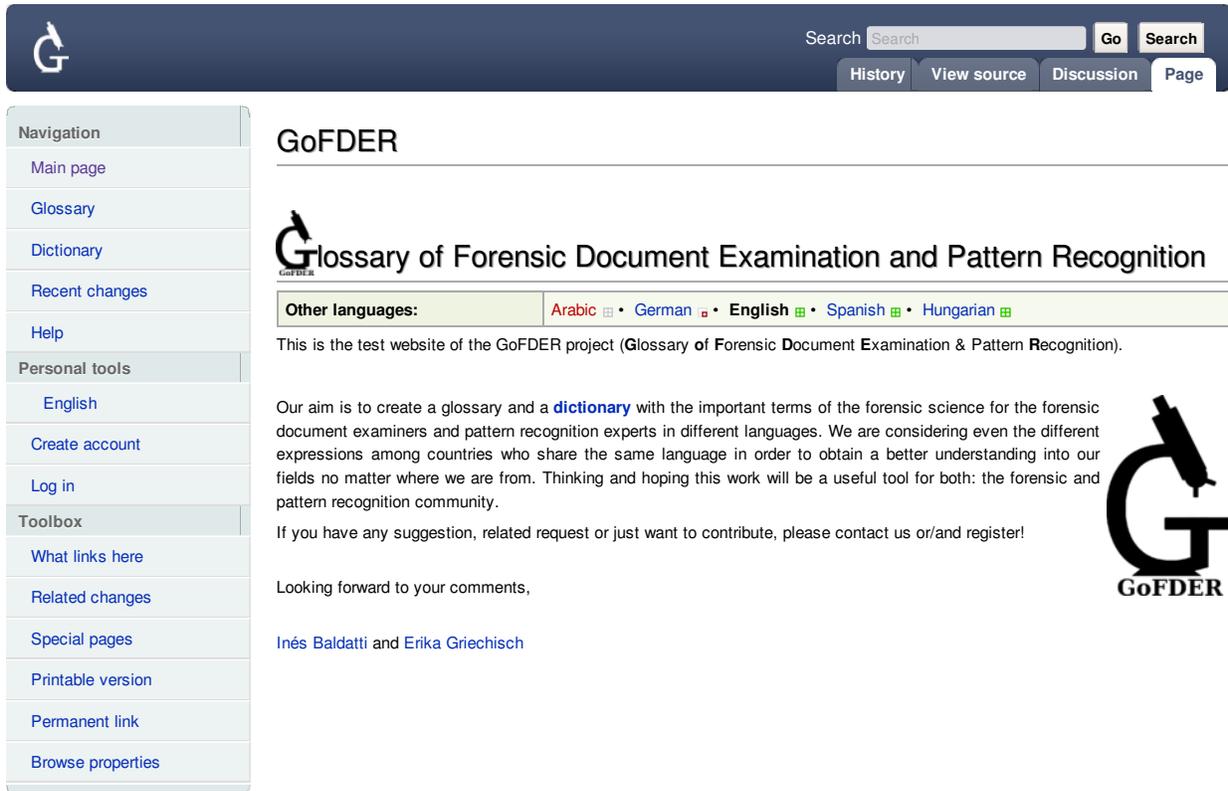


Fig. 5. Main page

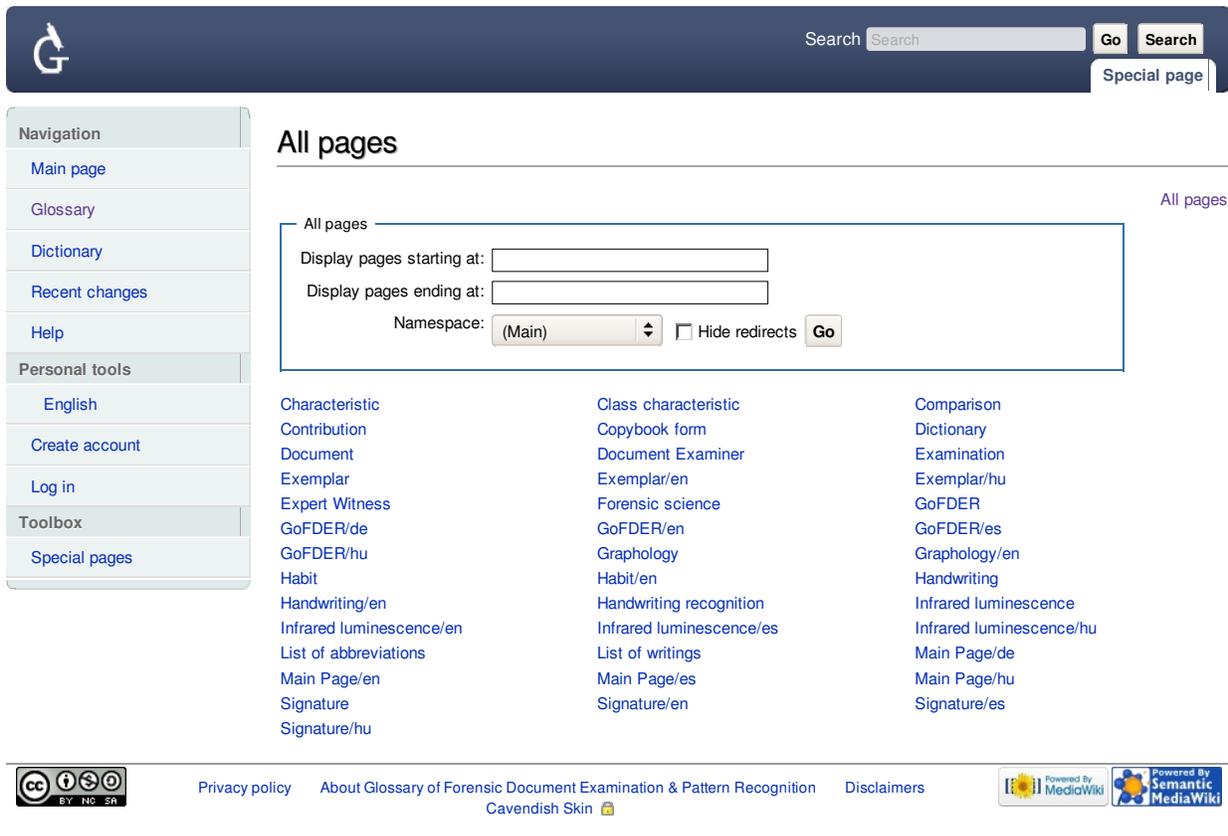


Fig. 6. Glossary – All pages