



## MODERN TECHNOLOGIES AND SOFTWARE FOR HANDWRITING EXPERTISE

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**Abstract.** In the modern world, law enforcement agencies are increasingly using the possibilities of science and technology in combating crime, one of the main ones being forensic examination. Handwriting expertise is also one of the most sought-after examinations. Artificial intelligence and software are capable of solving many tasks that were traditionally considered creative. Storing such systems in memory is especially important. The article examines the methods of application of software in research and the possibility of its use in individual methods of forensic handwriting expertise.

**Keywords:** handwriting expertise, artificial intelligence, software, Signature analyzer, DocuScan, software (HAS).

In recent years, several new technologies and methods have emerged in the field of handwriting expertise, which significantly improve the accuracy and effectiveness of experts' work.

Digital technologies are the collection, storage, processing, search, transmission and presentation of data in electronic form.

Scanning and analysis is the use of high-quality scanners to create document images. This allows the expert to work with images, details bases, and wires analysis, rather than with the original. Analysis software: Special programs that help compare handwriting samples, identify unique characteristics, and conduct quantitative analysis.[1]

Artificial intelligence and machine learning. Automated identification systems: Machine learning algorithms can be trained on large volumes of data to recognize and classify different handwriting styles.[2]

Let's consider templates: Using neural networks to determine features and features in handwriting, which helps to identify authorship.

3D modeling and visualization. Analysis of slope and pressure: Technologies allow for the study of pressure and the introduction of a drawing, which can provide additional information about the writing method.

New methods of expertise. Graphological research: Integration of graphology with handwriting for a deeper understanding of the author's personal characteristics. Comparative analysis: Modern handwriting comparison methods that observe a greater number of parameters, such as slope, letter form, and interval between them.[3]

Tools for experts. Mobile applications: application development, experts-specialists conduct initial analysis on the spot using smartphones and tablets. These new technologies allow us to improve the quality of handwriting expertise, making it reliable and accessible.

Aspects and functions of the software:

Object analysis is a visual and quantitative analysis of handwriting characteristics, such as slope, size, rhythm, and letter form. Sample comparison: The ability to download and compare different handwriting fragments to identify similarities and images. Support for different formats: Work with different types of files, including images and PDF documents. Report generation: Generating conclusions that can be useful in court proceedings or scientific research.

Advantages: Accuracy: Modern algorithms are used to improve the accuracy of analysis. Convenience: An intuitive interface that allows you to quickly master programs. Expert support: Provides useful tools for handwriting experts.

Disadvantages Cost: May be expensive for small organizations or independent experts. Technology dependence: Like any software, it can meet technical requirements.

In handwriting expertise, various programs are used, including those that use both Latin and Cyrillic, helping experts to analyze and conduct handwriting, as well as automate some processes. Here are some popular programs and their features:

Document Forensic Expert (FDE) Description: A powerful document analysis software that supports both alphabets. Function: to determine the analysis of documents, identify forgery and compare handwriting. Includes tools for scaling, brightness adjustment, and contrast. Advantages: High accuracy of analysis and comparison, a wide toolkit for working with documents, support for various image formats. Disadvantages: The high cost of the license, which requires time to study and review.

Signature Analyzer Description: Latin and Cyrillic signature analysis tool. Functions: Specializes in signature analysis. Compare by any parameters, including slope, size, and letter form. Advantages: Signature analysis specialization, a user-friendly interface for comparing signatures.

Disadvantages: Limited features for general handwriting analysis, less flexibility compared to other programs.

DocuScan Description: Support for both alphabets, suitable for many language environments. Functions: It is used for processing and analyzing documents. It provides high image quality and the ability to work with multiple formats. Advantages: High quality processing and image processing, ease of use for experts. Disadvantages: Low cost, limited analytical capabilities compared to FDE.

Handwriting analysis software (HAS) Description: Handwriting analysis software that supports both alphabets. Features: Provides handwriting analysis tools, including graphical parameters and statistical analysis. Can be used for experimental samples. Advantages: Affordable price. Handwriting analysis tools. Disadvantages: Limited functionality compared to more expensive programs. Analysis accuracy is not always high.[4]

ImageJ Description: Free image processing software that can be adapted for handwriting analysis. Functions: Free image processing software, which can be adapted for handwriting analysis. Quantitative analysis and visualization of data. Advantages: Free and open source software. Multiple plug-ins to expand functionality. Disadvantages: More complex interface for users without experience. Adjustments and additional knowledge are required for effective use.[5]

QDA miner Description: Software for high-quality data analysis, including Latin and Cyrillic text documents. Functions: A program for high-quality data analysis, which can be used to analyze texts and handwriting. Supports data encoding and annotation. Advantages:

Powerful tools for high-quality data analysis. Support for different text analysis formats. Disadvantages: Low ease of use for non-professionals. It can be a reserve for simple handwriting expertise tasks.[6]

Adobe Photoshop Description: Although it is not a specialized software for handwriting expertise, Photoshop supports both alphabets and is used for image processing. Functions: the ability to be used to prepare images, change contrast, and highlight small details. Advantages: High level of image editing and processing. [7]Widespread data visualization capabilities. Disadvantages: High license cost. Non-specialized software for handwriting expertise.

Every software has its strengths and weaknesses. The choice depends on the needs of the specific expert, the budget, and the level of training.

For example:

FDE or DocuScan is best for in-depth analysis of documents. Signature Analyzer can be used for specialized signature analysis. Adobe Photoshop or ImageJ are suitable for general analysis and image editing.

These programs allow experts to analyze handwriting and documents more accurately and effectively. The choice of software depends on the tasks facing the expert. The software is mainly useful for handwriting experts, which has a wide range of functions for analysis and comparison of handwriting.

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