

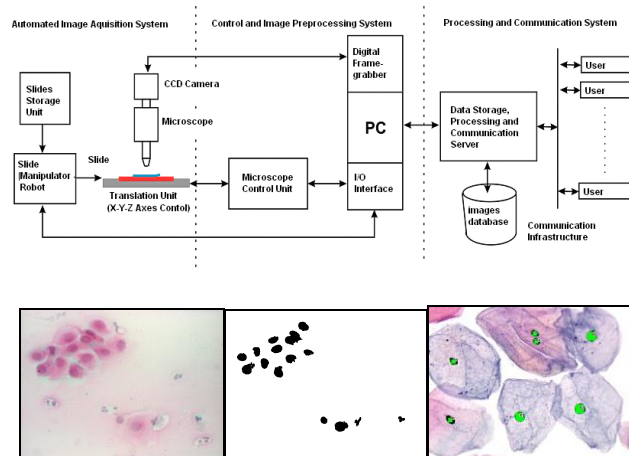
Synthesis for the PhD thesis entitled :

„Methods for Information Extraction and Interpretation in Medical Imaging”

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Mass screening programs of the population to identify seemingly healthy individuals has been a growing trend for over 30 years, to prevent the incidence of some diseases which represent a substantial public health burden. A screening program is able to alert the specialists to check further, if abnormal cells were detected. Cervical Intraepithelial Neoplasia (cervical cancer, called CIN) is one of the most common form of cancer among women worldwide death, but if it is discovered early the chances of a cure are as high as 90 percent. The traditional screening test is called Pap smear and consists in the examination of cells collected from the uterine cervix in a cytology laboratory under the microscope. Even the best laboratories can miss from 10 up to 30% cancerous cases (false negatives), or made some mistakes (false positives) due to the following reasons: huge number of normal slides being analyzed, each containing a huge number of cells, the big number of slide's zones (views) that must be explored under microscope, and the short time allocated to each slide (10-15 minutes). In this case the “cost” of false negatives is much important then false positive rates. For the human eye is difficult to detect all cases of cancer (without error); as a result, this inconvenience lead to the necessity of some automated methods for cancer detection to assist diagnosis. In this thesis a **computer diagnosis tool** that is very helpful in medical automatic guidelines was proposed.

Cap 1. Technological and medical aspects concerning computerized screening procedures of CIN grade diagnosis: in this chapter we present preliminary information to assure a framework to compare the proposed computerized screening systems with the other official FDA approved systems. Architecture is adapted to minimal cost and versatility. It is an integrated medium and algorithms work in the same acquisition conditions. The functionality is comparable with expensive FDA approved systems. It was adapted to work in the condition of classical “*Pap stain*” slides. **Cap 2. Global structure of the proposed system for the CIN's assisted diagnosis:** original system architecture was proposed for screening test. It consists of four implemented modules - acquisition and medical images storage module, preprocessing module (described in chapter 3), analysis module (chapter 4), and communication module (chapter 5).



Structure of the proposed system and segmentation and labeling efficiency

Cap3. Segmentation methods for Pap-smear images: First step of the automated screening system for CIN grade detected is the segmentation of cells from digital image. *Multi-spatial and hybrid segmentation algorithm* is proposed for robust segmentation of nuclei that overcomes the bad quality of the prepared smear slides. It was developed an original method for abnormal nuclei detection based on optimized hit&miss method that provide high speed processing and robust detection. Also an original cytoplasm segmentation method based on posterized and cluster cells divided techniques. All techniques was integrated into an image processing tool with modular structure based on object oriented paradigm, that permit the comparative evaluation of these algorithms results. **Cap 4. Classifier's performance characteristics for CIN grade category [ACAM]:** in this chapter is presented an original classificatory with improved performances based on Statistical pattern classification. **Cap 5. Virtual screening cytological laboratory:** it was developed two securized WEB-based application (WEBLab și WEBAtlas) based on SNOMED codification. These applications were integrated into a Virtual screening cytological laboratory and consist of: *distance-learning* – for special cases specialist training and knowledge testing, *distance-consulting features* – for the patient-results cytological analysis, provided to specialist that are clients of that laboratory.