Belarusian State University of informatics and Radioelectronics

Computer systems department. Pattern identification computer systems lab.

- Main work directions
- Projects
- Prospects of development

Main work directions

- Real-time multiprocessor systems and parallel architectures.
- Information processing and pattern recognition computer systems.
- Biometrics.
- Video surveillance.
- Distributed information processing systems (GRID)

Multispectral satellite images processing system

Information processing
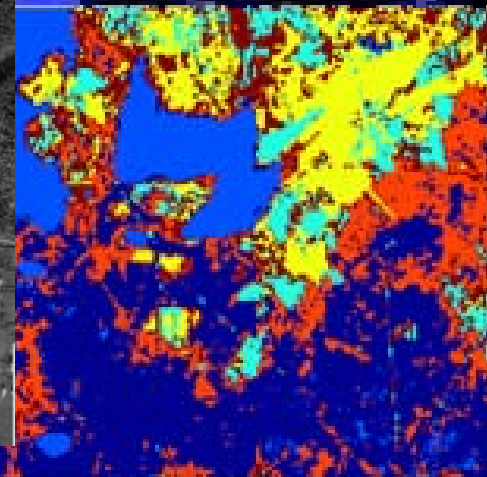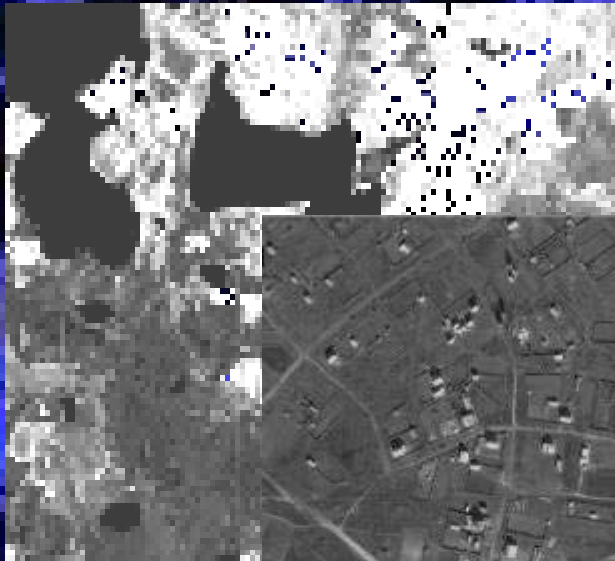
PURPOSES:

Processing of the information from artificial satellites of the Earth:

- **Locality linkage.**
- **Objects recognition.**
- **Objects classification.**

Video processing in surveillance systems

Image processing

PURPOSES :
Development of video processing methods for   intellectual surveillance systems.

APPLICATIONS:
Movement of objects control.
Speed control.
Tracking.
Interconnections of objects.
Object classification.

Pedestrians counting system

Image processing

PURPOSES :
Counting of pedestrians that pass specified area in a crowd stream or moving freely.

TASKS:
Video preprocessing.
Motion detection.
Optical flow estimation.
Object tracking
Movement magnitude and direction analysis.

Parallel application development for supercomputer configurations
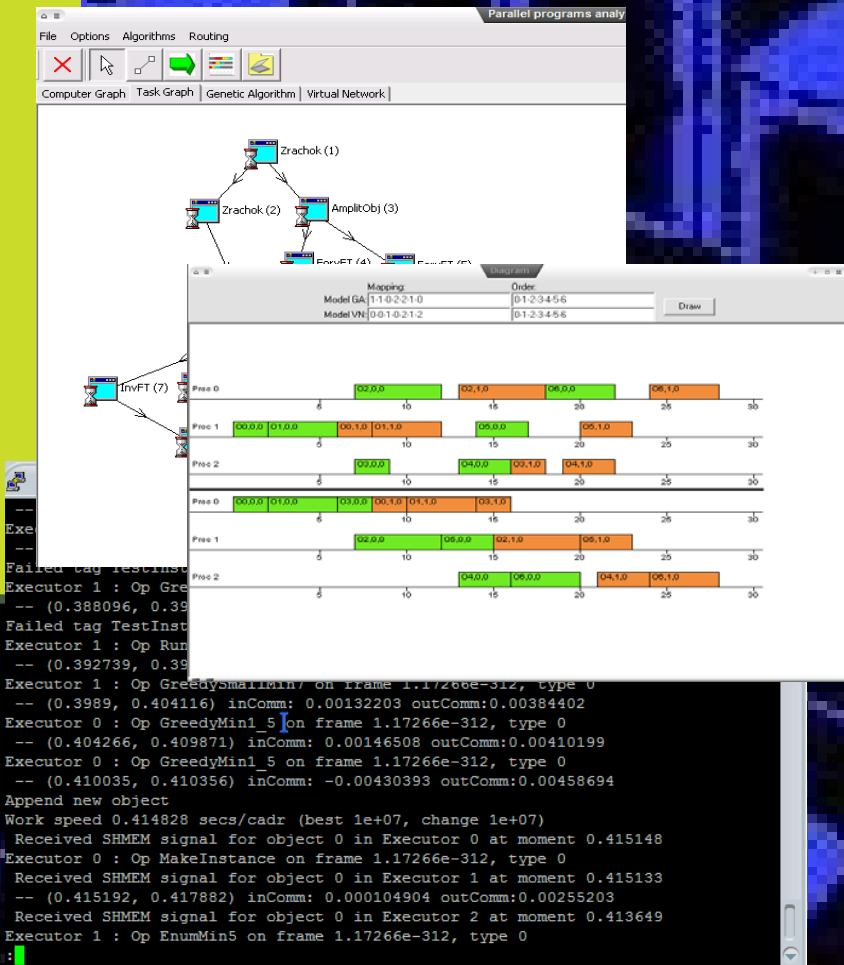
Image processing

Goals:

Development of automated tools for programming of parallel applications

Features :

Creation of parallel application graph in visual editor;
Analysis and optimization of applications;
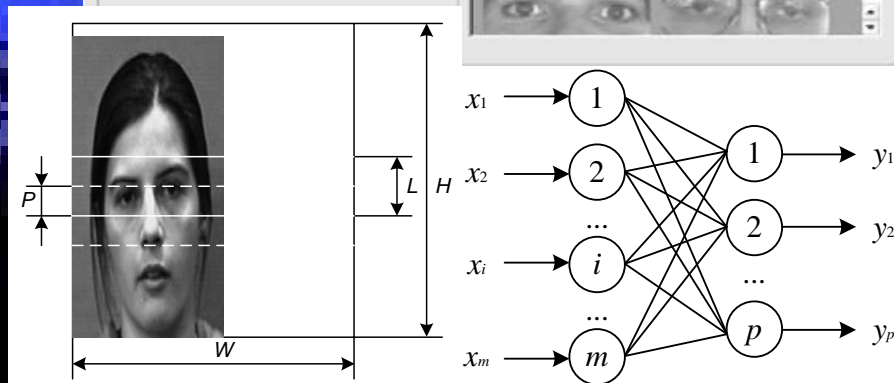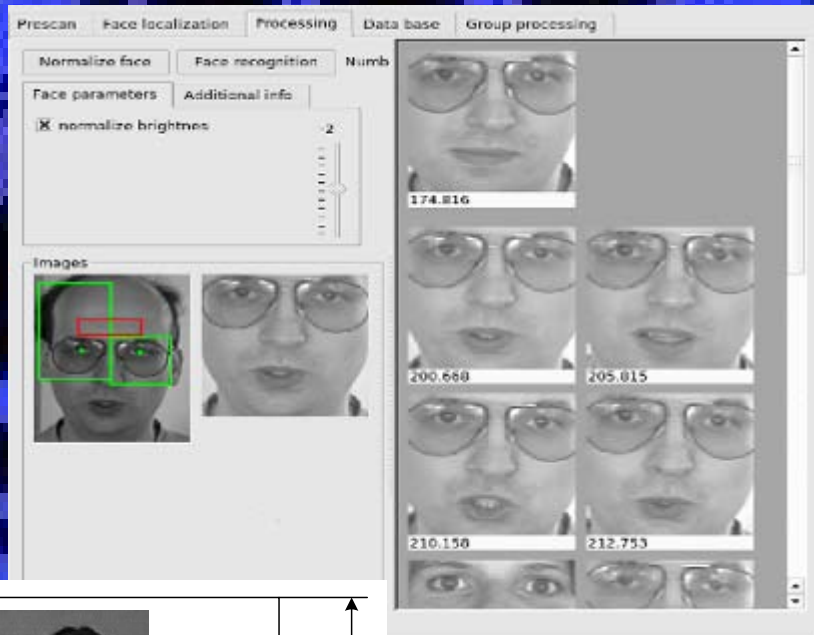Application adaptation for running on parallel computer.

Advantages :

Evolutionary optimization approach.
Dynamic optimization of parallel performance.
Component-based programming model.

Face processing system

Image processing

PURPOSES :
Face detection
Face recognition
Face searching in big data base
METHODS:
Haar classifiers cascade
Eigenfaces
Hidden Markov model
DATA BASES:
BioID
AR face database

Stereo images analysis

Image processing

PURPOSES :
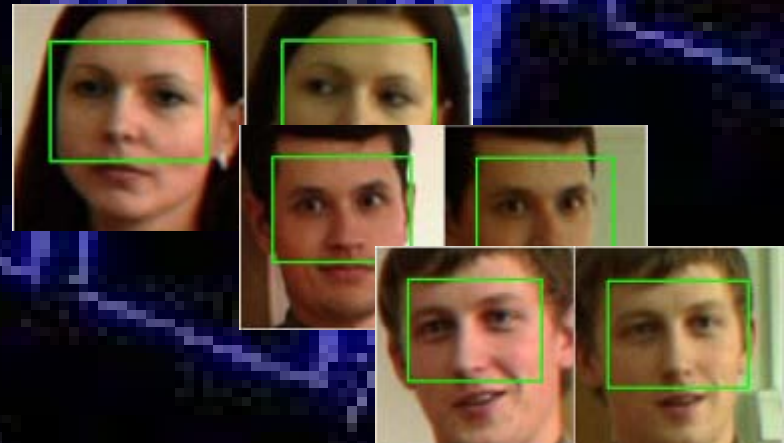**Automated reconstruction of 3D scene model for different purposes.**
TASKS:
Objects detection (faces).
Correspondence estimation between object views.
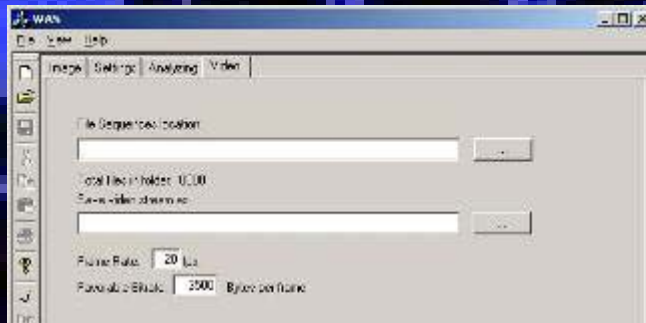**3D position estimation.**
3D object model reconstruction

# Digital image and video compression system

Image processing

Method is based on fast wavelet decomposition (FWT) and FSPECK coding

MAIN FEATURES:

- **Compression ratio 10-15% better than JPEG**
- **Fast compression (0.1 sec for 512x512 image size)**
- **Low noise and input image distortion**
- **Effective for large images**
- **Simple video compression architecture**

Textile fiber analysis system

Image processing
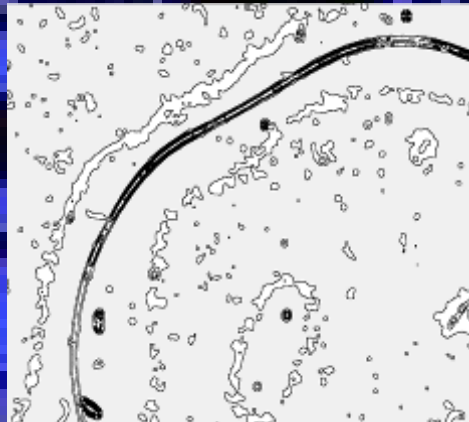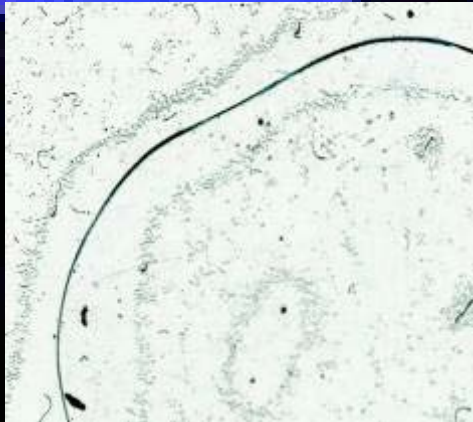
PURPOSES:
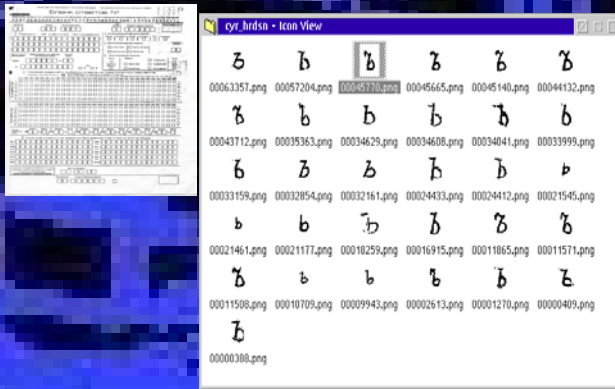**Textile fibers images processing for criminalistics expertise:**
- **Fiber detection**
- **Classification**
- **Samples matching**

TASKS:
Edges detection.
Morphological operations.
Lengthy objects detection.
Color, shape and size analysis.

Experimental system for handwritten symbols recognition

Image processing

PURPOSES :

Hand filled forms processing automatization for the next task
- **population census**
- **voting**
- **questioning**

and others there marked forms can be used.

FEATURES :

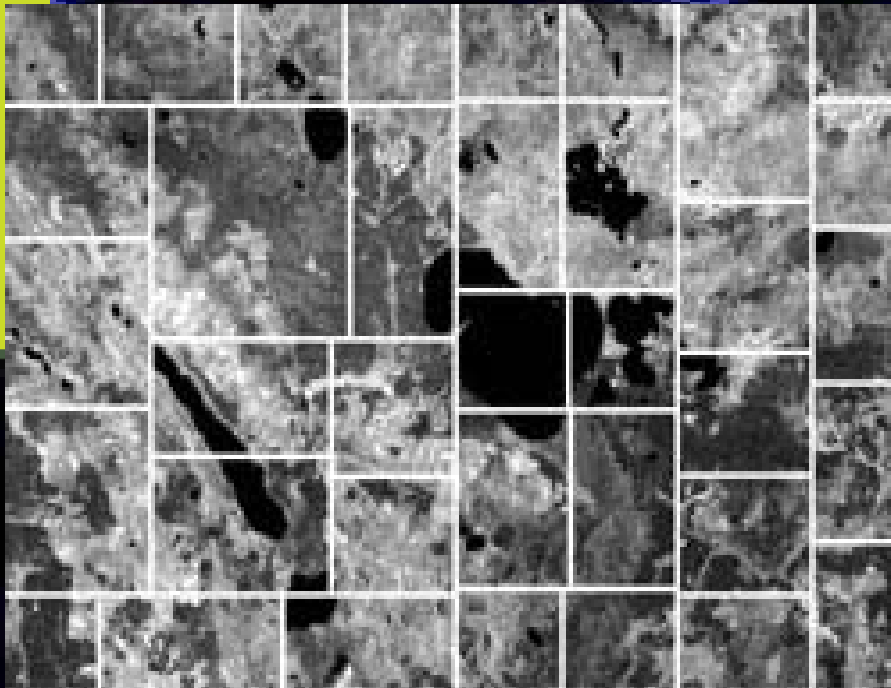**FPGA implementation of classifier.**

TASKS :

Form image alignment.
Symbols estimation.
Symbols recognition.
Dictionary support.

Large image decomposition system

Image processing

Satellite image decomposition example

The system utilizes content-adaptive decomposition scheme to provide the best way to store images in content-based image retrieval systems.
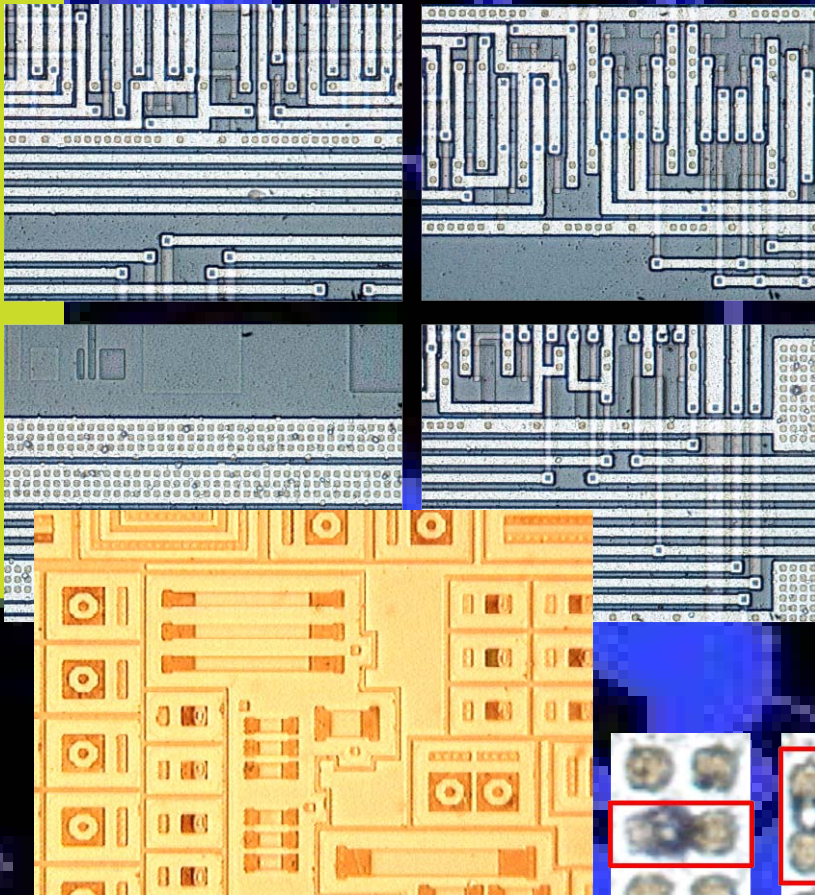
FEATURES:

- Fast access to any region of large image;
- Adaptation to image content in order to eliminate redundancy of data returned by request;
- Support of random and content-based queries.

Integrated circuit topology layerwise automated reconstruction system

Information processing

PURPOSES :

Integrated circuit topology reconstruction based on images obtained by optical vision system
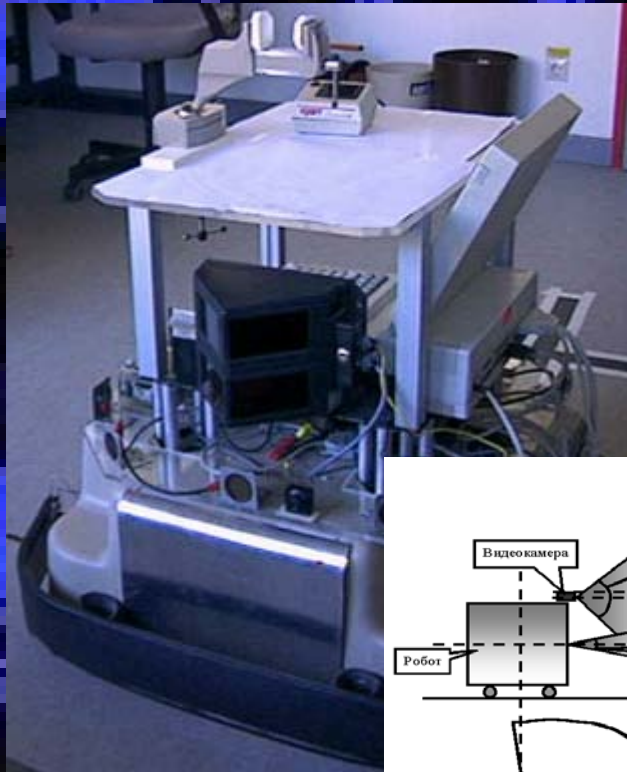
APPLICATIONS :

• **Photomask control.**
• **Recognition of the objects on integrated circuit.**
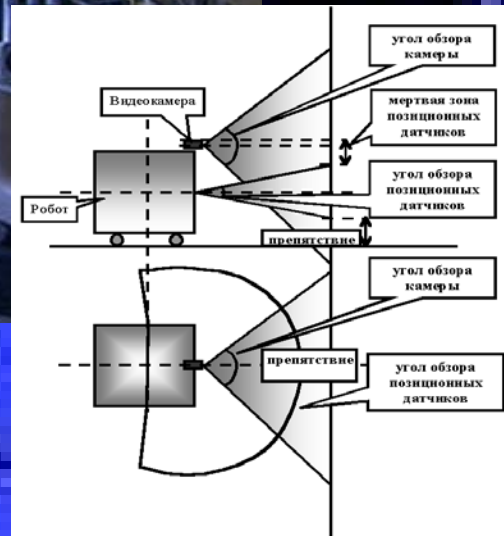• **Defects detection and classification.**

Intellectual neuron system for autonomous mobile robot control
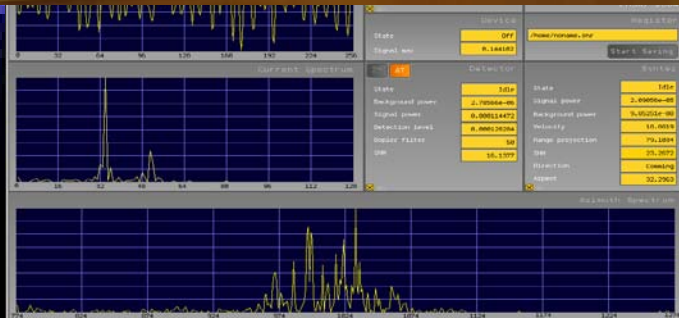
Information processing

PURPOSES :
Mobile robot control in unknown structural surrounding based on monocular video images processing

Radar signal processing system

Information processing

PURPOSES :
- automated moved object detection;
- motion parameters estimation;
- length measurement and classification moved overland objects;
- object information representation.

FEATURES:
Parallel realization using SKIF supercomputer.
Broadband signals modeling

Prospects of development

- **Development of the systems for SAR-images processing**
- **Creation of the GRID computing systems.**
- **Development of the systems for parallel and distributed information processing.**
- **Development and distribution biometric identification systems**