



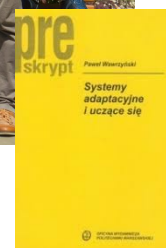
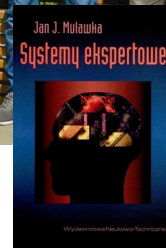
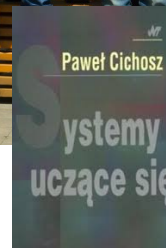
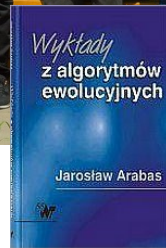
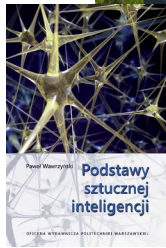
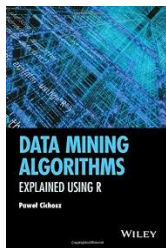
Institute of Computer Science  
Warsaw University of Technology

# Artificial Intelligence Division

Warsaw, 2020

## Artificial Intelligence Division (14 staff, 10 PhD students, 40 diplomants)

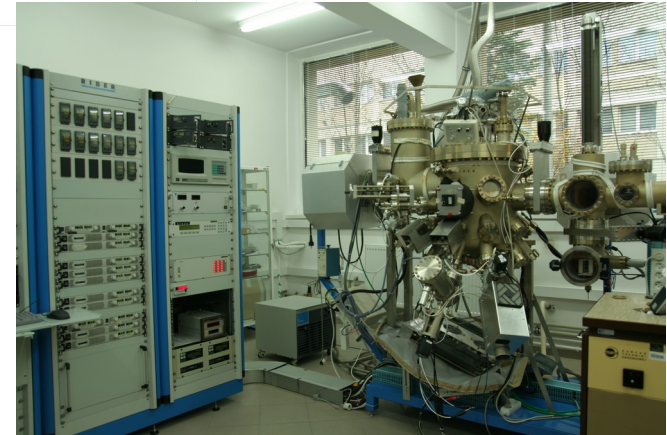
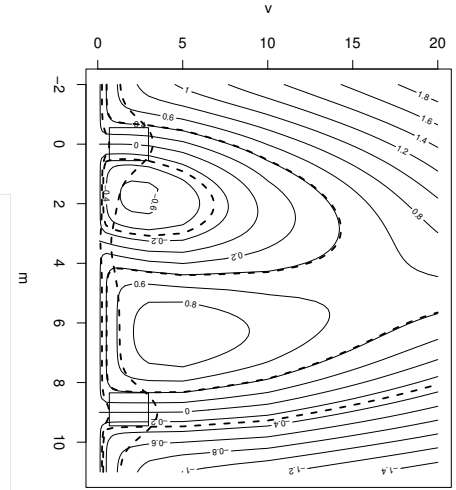
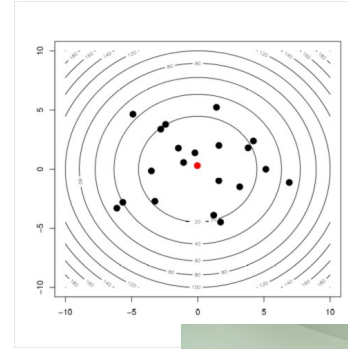
- Jan Mulawka, Prof, PhD, DSc
- Jarosław Arabas, PhD, DSc
- Robert Nowak, PhD, DSc
- Paweł Wawrzyński, PhD, DSc
- Rafał Biedrzycki, PhD
- Paweł Cichosz, PhD
- Stanisław Kozdrowski, PhD
- Karol Piczak, PhD
- Krystian Radlak, PhD
- Paweł Zawistowski, PhD
- Wiktor Kuśmirek
- Jakub Łyskawa
- Łukasz Neumann
- Witold Oleszkiewicz



<http://ai.ii.pw.edu.pl>

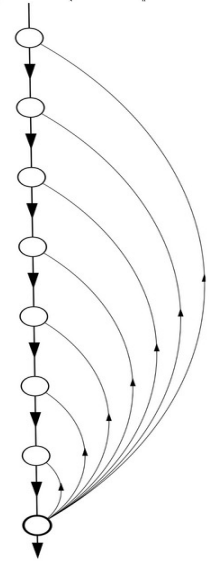
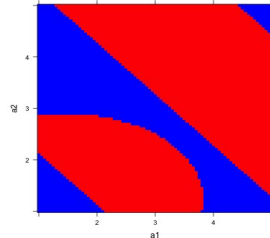
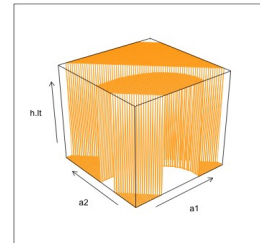
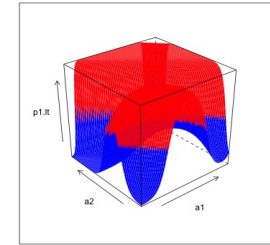
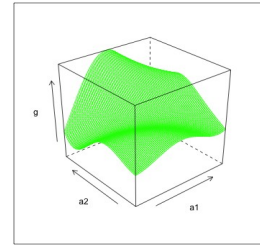
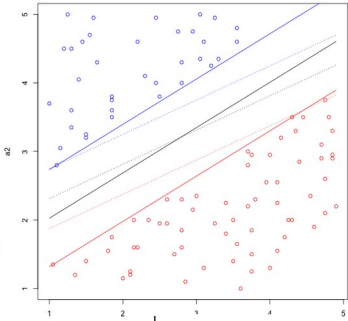
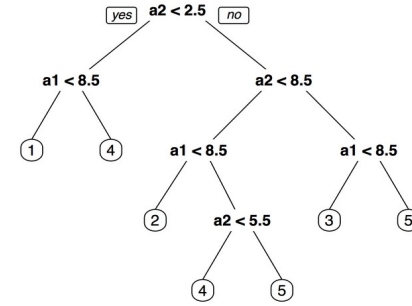
# New optimization methods based on evolutionary algorithms

- Modeling of evolutionary algorithm properties
- New version of optimization algorithms
  - high ranking in international competitions:
- Optimisation methods used in practice:
  - Semiconductor mirror
  - Calibration standards
  - Optimization Jiles-Atherton model
  - Optimization of motif searching in DNA

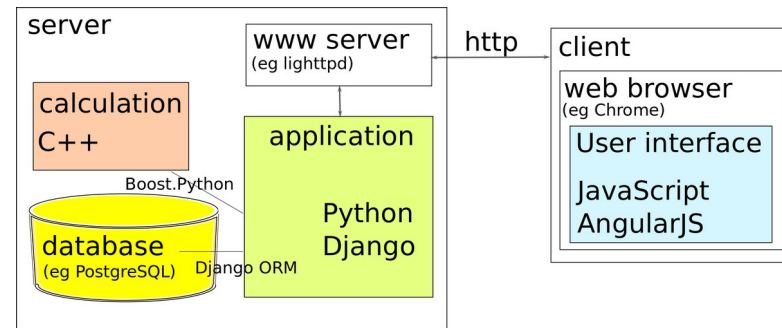
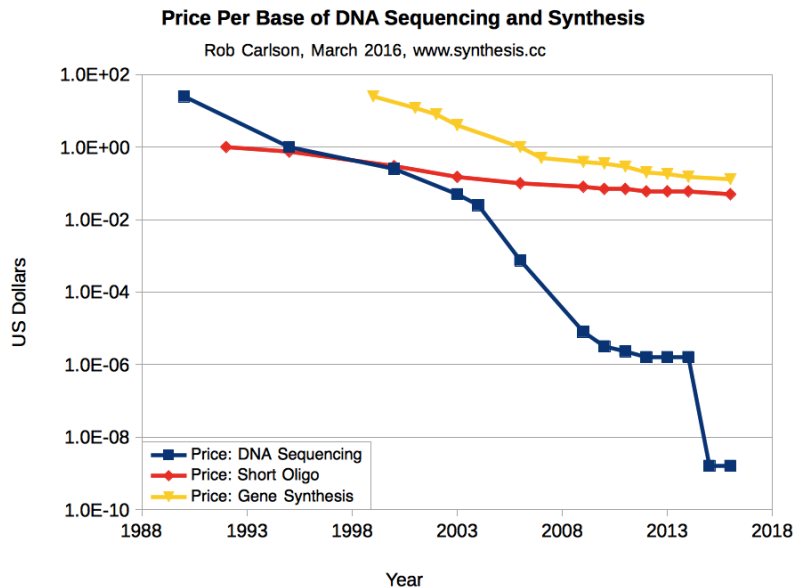


# Machine Learning Algorithms

- **Predictive modeling:** learning classification, regression, and clustering models
- **Neural networks**, deep learning, convolutional, recursive, LSTM
- **Anomaly detection:** learning patterns of normal and anomalous behavior or events
- **Text classification and clustering:** assigning or discovering document classes
- **Collaborative filtering:** learning user/customer interest patterns from ratings
- **Reinforcement learning:** learning decision/control policies from delayed rewards



# Genomics and synthetic biology



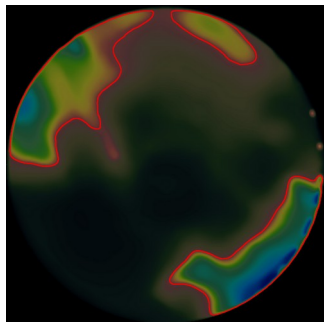
**Areas of interest:** Assemblers NGS, Genomic Variant Data Warehouse, Variant Prioritization, Quality Control Software for NGS data, Copy Number Variation Detection, Haplotype Analysis, Artificial Gene Synthesis

**Technologies:** Bioweb framework, Hadoop, Apache, Kafka, Kylin, R, C++, CUDA

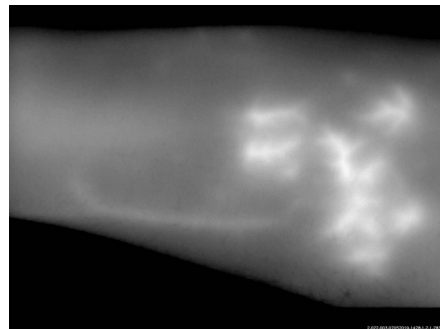
**Collaboration:** Warsaw Medical University, Warsaw University of Life Sciences, Institute of Mother and Child in Warsaw, ETH Zurich, Baylor College of Medicine (Houston)

# Medical image analysis

Breast cancer detection using thermal images, 1 M PLN, Braster SA



Skin allergy response detection using visual & thermal images, Milton-Essex SA



- image processing, feature extraction, feature significance
- machine learning (classifiers)
- efficient implementation in C++, concurrency
- used in production as SaaS, cooperation with external systems.



# Financial data analysis

**Data cleaning:** missing attribute values calculation, misspells (dictionary based, ontologies),

**Feature generation**, eg. public transport availability, population of the city, weather, weather forecast, public holidays

**Model building:** bayesian, random forests, neural networks, SVM and others

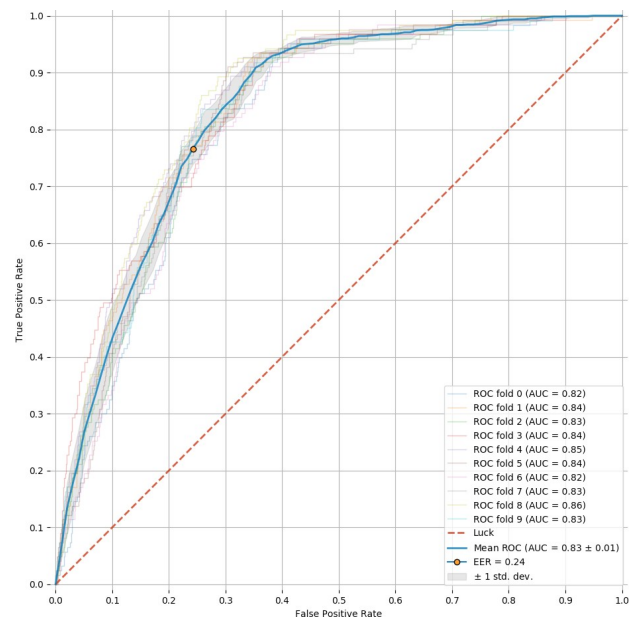
**Attribute significance**

**Cost matrix**

**Business process change calculation**

**ROI estimation**

**Example:** the need for replacement vehicle for car insurance companies





## Activities (2017-2020):

- **Teaching:** Bioinformatics, Artificial intelligence, Machine learning, Knowledge discovery methods, Heuristics and metaheuristics algorithms, Reinforcement learning, Advanced Neural Networks, Evolutionary methods, Object programming, Advanced object programming, Design patterns
- **Projects with industry:** Braster, AdWords, Aspartus - Axa, Aspartus - Generali, Milton Essex, RosMedia, PatentFund, Samsung Polska, Gamehill, MakeltRight, Sales Intelligence, Infoklinika, VirtuAI, Euros Energy, Horizen
- **Publications:** 50+ articles in scientific journals, 3 patents, 14 chapters in books, 50+ manuscripts in conference proceedings

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Institute of Computer Science  
Warsaw University of Technology

Artificial Intelligence Division

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**Thank you**

[robert.nowak@pw.edu.pl](mailto:robert.nowak@pw.edu.pl)