

# Computational Intelligence Group

## Projects & Research Interests

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**`http://cig.felk.cvut.cz`**

Department of Computer Science and Engineering  
Faculty of Electrical Engineering  
Czech Technical University in Prague

# Team & Scope

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- 5 employees
- 6 PhD students
- 1 guest researcher (currently 3 months)
- Datamining, computational intelligence, artificial neural networks, evolutionary algorithms



# Cooperation

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- IBM Research Czech Republic
- Seznam (czech information portal)
- National museum
- 1<sup>st</sup> and 2<sup>nd</sup> Medical faculty, Charles University
- Faculty for Human Studies, Charles University
- Sun Microsystems ???

# Scientific Conferences Organized

- International Conference on Artificial Neural Networks 2008 (biggest neural network meeting in Europe), 260 participants
- IWIM 2007 and ICIM 2008 – Conferences on inductive modeling, ~60 participants

[illegible]

# Upcoming Event

- EUROSIM 2010
- Biggest european simulation congress

**EUROSIM 2010**  
organised by CSSS  
September 2010, Prague, Czech Republic



**EUROSIM 2010**  
7<sup>th</sup> EUROSIM Congress on Modelling and Simulation  
Eurosim Congress the most important modelling and simulation event in Europe  
September 2010, Prague, Czech Republic  
**Congress Venue**  
The Congress will take place in Prague, the capital city of Czech Republic, at the Congress Center of Masaryk College, part of Czech Technical University, in cooperation with the Faculty of Electrical Engineering of CTU.  
**About Czech Technical University in Prague**  
Czech Technical University celebrates 130 years of its history in 2009. Under the name Czech Engineering Teaching Institute in Prague was founded by the receipt of the Emperor Josef I on 8 January 1707 on the basis of a petition of Christian Josef Willenborg (1678-1731). His school was reorganised in 1808 as the Prague Polytechnic, etc., after the elimination of the former Austria-Lorraine Empire in 1918, transformed in to the Czech Technical University in Prague.  
**About EUROSIM**  
EUROSIM, the federation of European simulation societies, was set up in 1989. Its purpose is to promote, especially through national simulation societies, the idea of modelling and simulation in different fields: industry, research and development. At present, EUROSIM has 14 full members and 4 observer members.  
**Congress Scope and Topics**  
The Congress shall include all aspects of continuous, discrete (event) and hybrid modelling, simulation, certification and optimisation approaches. Contributions from both technical and non-technical areas are welcome. Two basic tracks will be organised: M&S: Methods and Technology, and M&S Applications.  
**Czech Republic - EUROSIM 2010 Host Country**  
The Czech Republic is a country in the centre of Europe. It is interesting for its 1,000-year-long history, rich culture and diverse nature. The country is open to new initiatives and opportunities. It has a high level of industrial infrastructure, highly educated and young people. The location of the Czech Republic in the very heart of Europe contributes to the fact that it is not far from any country. Usually all travellers to enter the country is a valid passport. The need for a visa to enter the Czech Republic is very exceptional.  
**Prague - EUROSIM 2010 Host City**  
Prague is a magical city of bridges, cathedrals, gold-tipped towers and church spires, whose image has been mirrored in the surface of the Vltava River for more than a millennium. Walking through the city, you will quickly discover that the entire history of European architecture has all splendid representations of various periods and styles. There are Romanesque, Gothic, Renaissance, Baroque and classical buildings, as well as more modern styles, such as Art Nouveau and Cubist. A poet once characterized Prague as a symphony of stones.  
**About CSSS**  
CSSS (The Czech and Slovak Simulation Society) has more than 150 members in 25 groups connected to 18 Czech and Slovak national scientific and technical societies (Czech Society for Applied Cybernetics and Informatics, Slovak Society for Applied Cybernetics and Informatics). Since 1992 CSSS is a full member of EUROSIM.  
**Invitation**  
Czech and Slovak Simulation Society is greatly honored with the congress organization and would be best to organize an event with a high quality scientific programme with some social accompanied sessions or also with some unforgettable social events.  
**Prof. Miroslav Alešák, main invited for next EUROSIM chairman, Prof. Miroslav Marek, president of CSSS**



# Ongoing Projects

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- **FAKE GAME** – open source data mining tool
- **CIV toolkit** – algorithms for Cell processor
- **RoboNEAT** – neuroevolution of robots
- **MathSC** – Mathematica softcomputing toolbox
- **BlueCar** – mobile robot for intelligent rooms
- **SiMoNNe** – simulator of modular Neural Nets
- **jCool** – nature inspired optimization package
- **PREPit** – automated data preprocessing

# Completed Projects

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- SiMoNNe – simulator of modular Neural Nets in Java
- Building interior reconstruction from unstructured point clouds by self-organization
- Parkinson disease analysis
- Parrots speech recognition
- StockSOM – online clustering of MarketWatch messages

# Datamining Applications

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- Anthropological data modeling
- Fetal weight prediction
- Parkinson disease analysis
- Biological signals datamining (EEG, EKG, ...)
- Datamining from GPS tracks



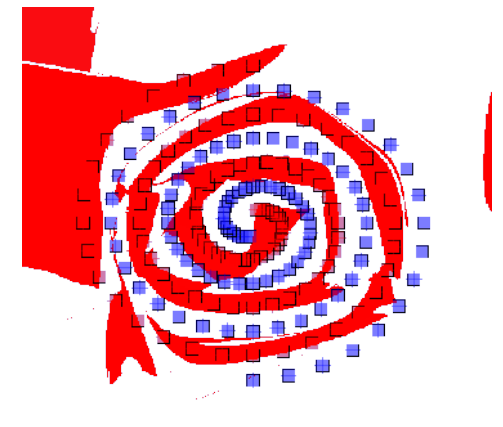
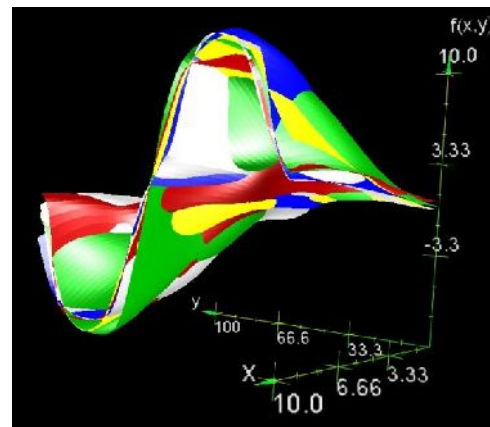
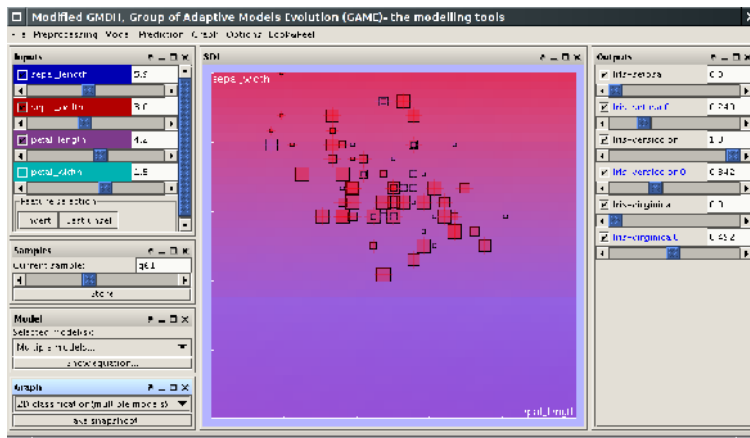
# Algorithms Developed

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- **GAME** – evolution of hybrid inductive models
- **THSOM** – temporal data clustering
- **CEA** – continuous evolution of individuals
- **DEANN** – evolution of neural networks
- **ANTCAST** – ant colony with castes

# FAKE GAME

- FAKE (Fully Automated Knowledge Extraction)
- by GAME (Group of Adaptive Models Evolution)
- Inductive modeling datamining tool
- Implemented in Java, opensourced in 2007  
<http://sourceforge.net/projects/fakegame/>



# CIV Toolkit

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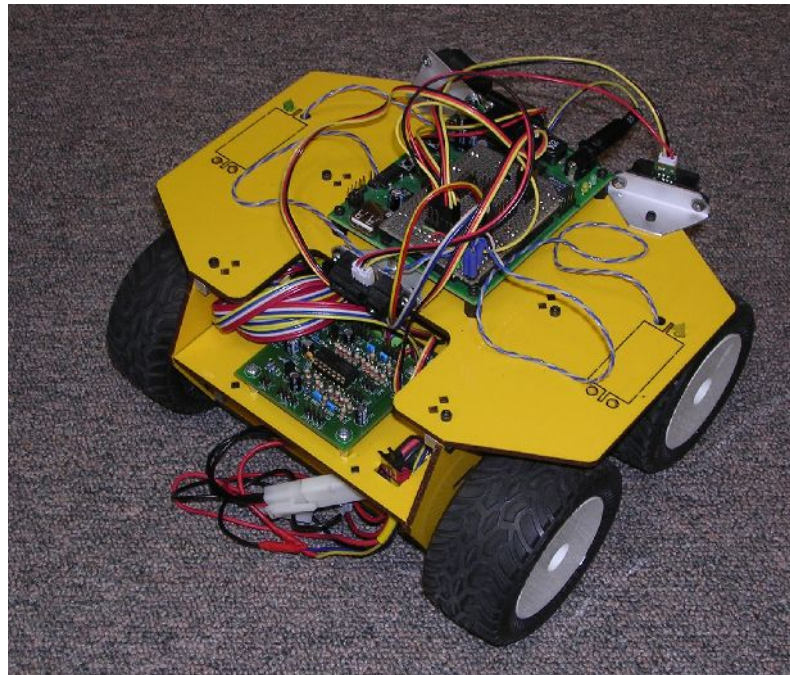
- Computational Intelligence and Voice Processing Toolkit on IBM Cell Broadband Engine
- 6x PlayStation3 (up to now)
- HMM, DTW, PSO, SOM, Neural Gas, Genetic Alg.
- <http://axon.felk.cvut.cz/civtoolkit>



# BlueCar

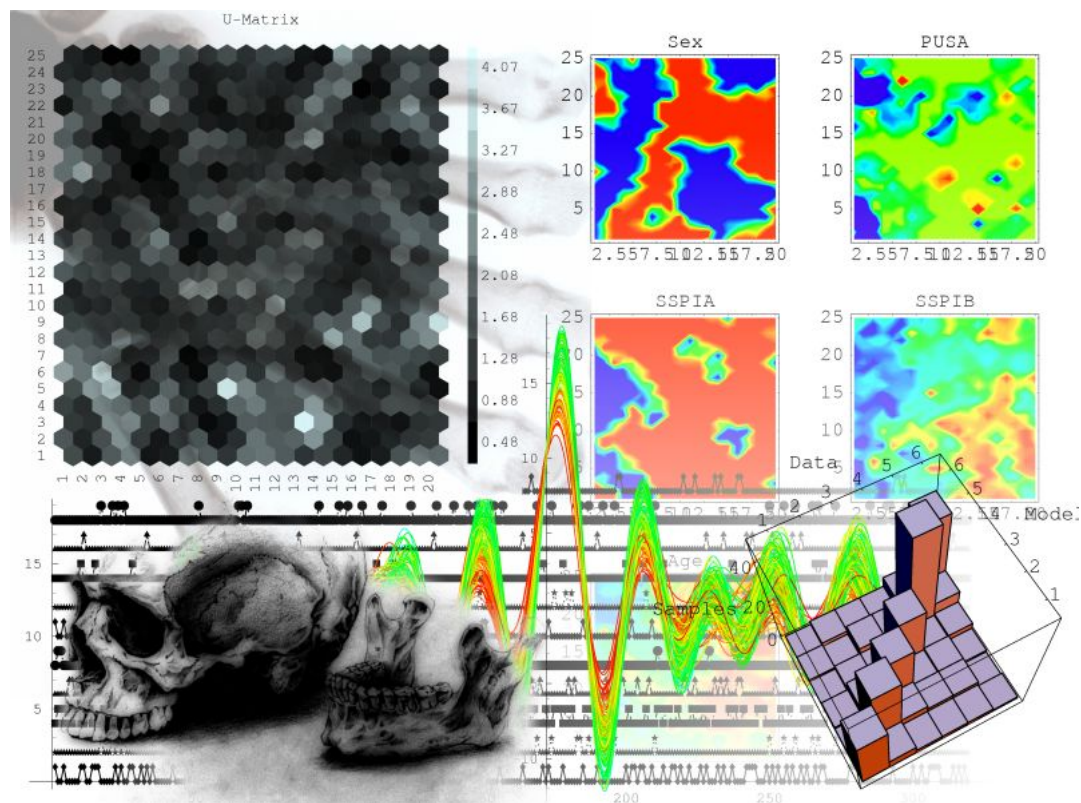
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- Mobile platform carrying audio port, accelerometer and other devices,
- Navigated by laser pointer
- Intelligent audio port for conference rooms



# Anthropological data modelling

- Processing of high dimensional and noisy data
- Decoding of age of skeletons from their measurements





# Estimation of Fetal weight

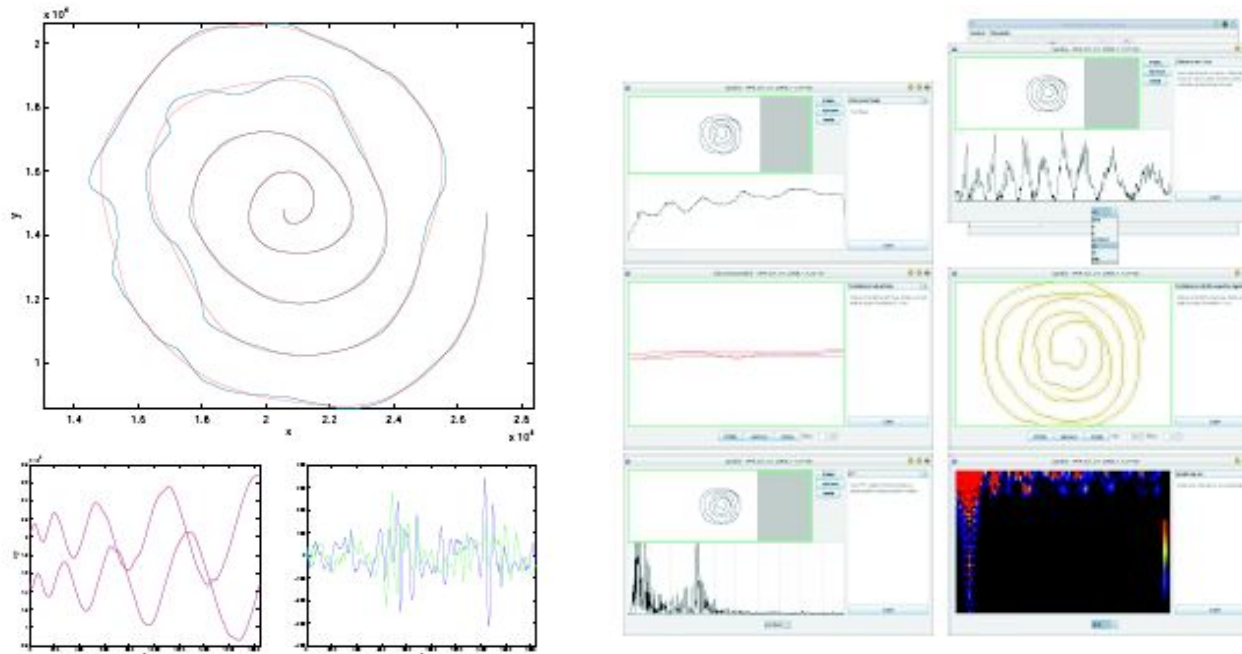
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- Find accurate model of fetal weight prediction
  - Based on sonography measured data during pregnancy shortly before delivery
  - $EFW = 0,0504AC^2 * 16,427AC + 38,867FL + 284,074$



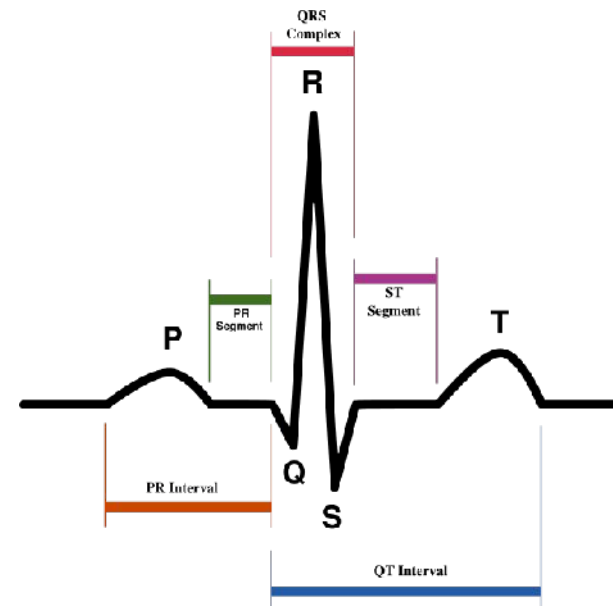
# Parkinson Disease Recognition

- Analysis of spirals drawn by hand (from tablet)
- Diagnostic application for 2<sup>nd</sup> Medical Faculty hospital



# Mining Biological Signals

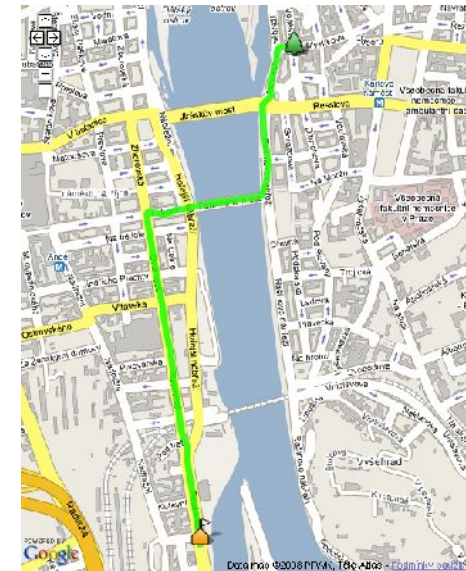
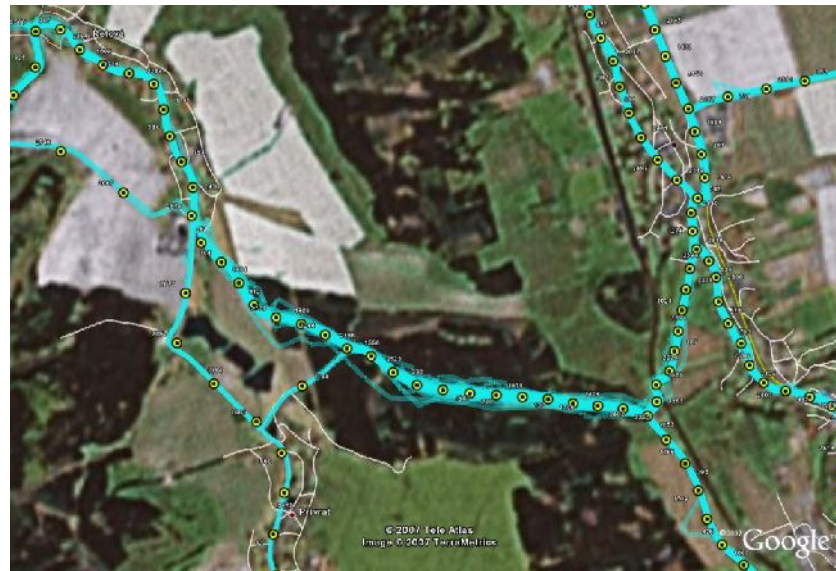
- Interest in data mining mainly but not limited to medical applications.
  - Sleep stages recognition based on EEG
  - Heart contractions shapes classification based on ECG





# Colabroute

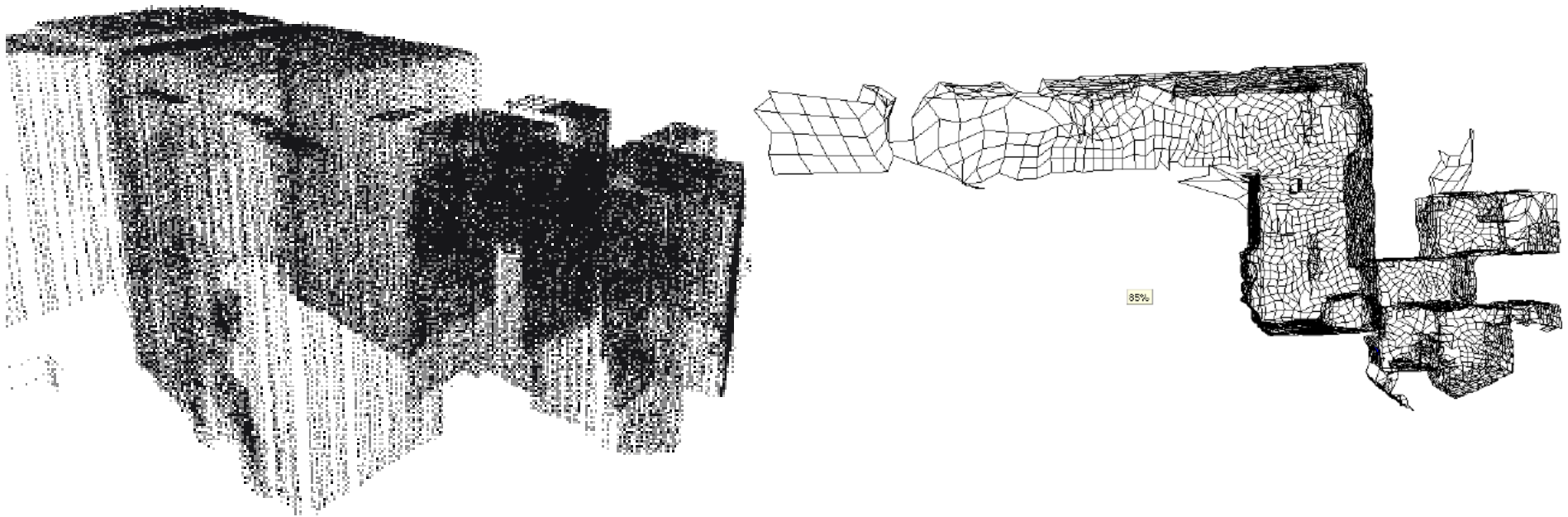
- Datamining from GPS tracks
- Automated construction of routable road maps
- Automated extraction of points of interest (Fuel stations, dangerous crossroads, ...)



# ShapeSOM

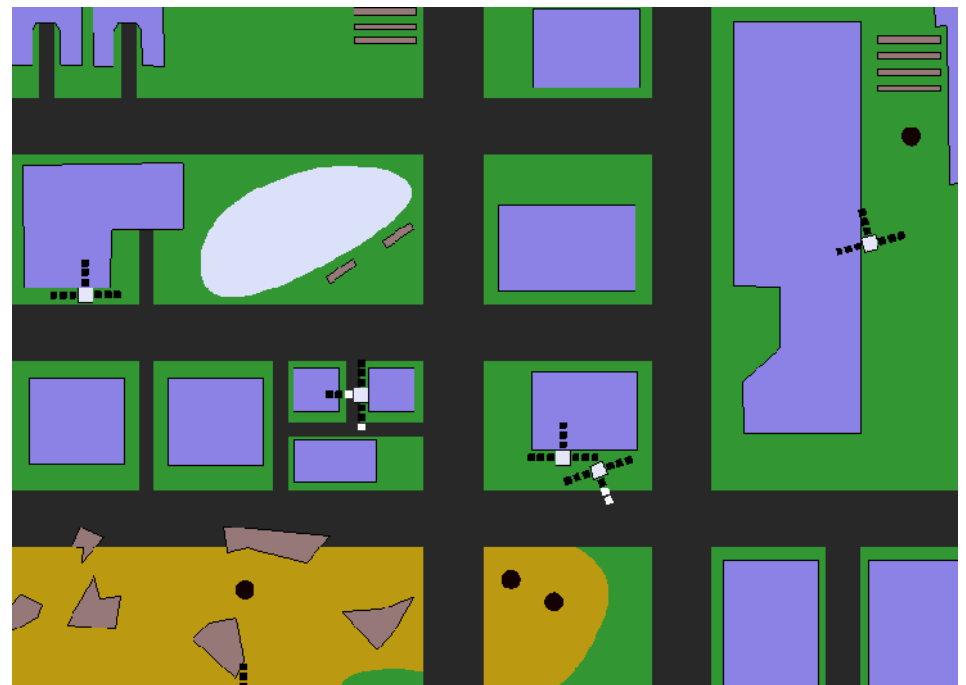
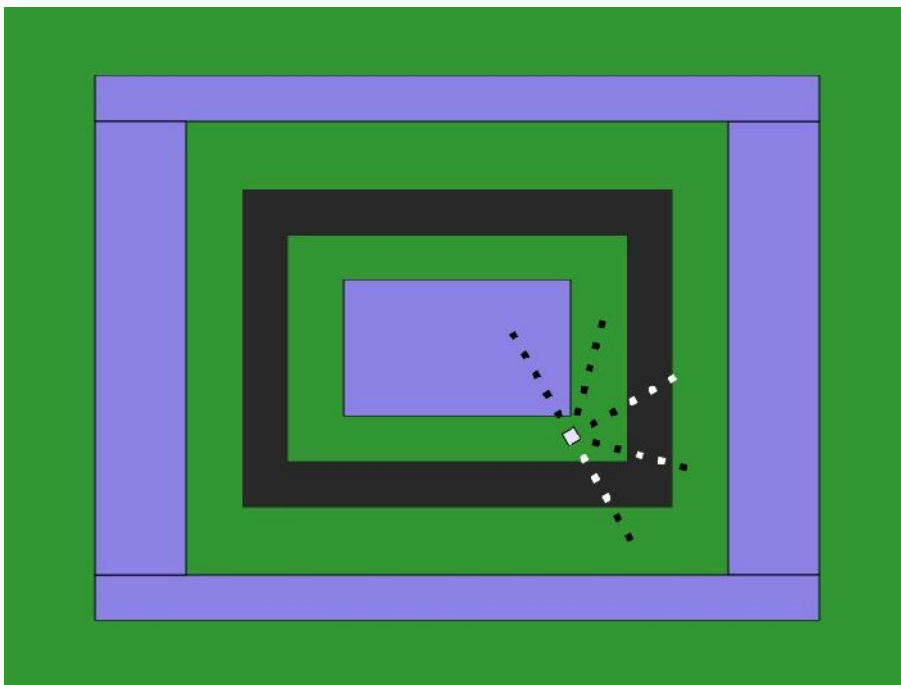
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- Reconstruction from unstructured vector clouds
- Self-organizing Maps
- Application in mobile robotics



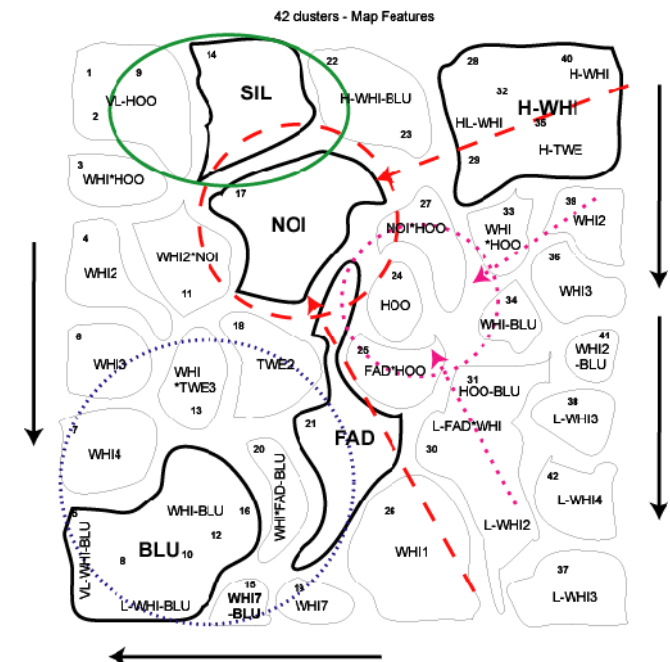
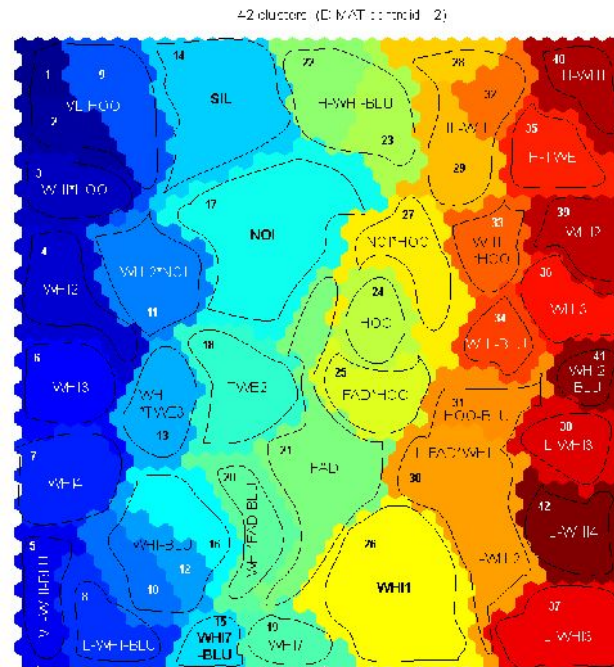
# RoboNEAT

- Neuroevolution of robotic controllers
- Simulation environment in Java



# Parrot Speech Analysis

- Speech Recognition Methods applied to analysis of voices of grey parrots.
- Clustering of samples by Self-organizing Maps



# Cooperation Proposal

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- Datamining in large spatio-temporal datasets
- Large dimension (number of features/columns in data)
- Big cardinality (number of data vectors)
- Building of understandable model
- Discovering of clusters and their relationship
- Relationship in time



Question and answers  
Thank you for your attention

