



# *Post-Graduate Program in Computer Engineering (PPG-EC)*

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# *Brief History of PPG-EC*

- Pioneer in North, Northeast and Mid-West of Brazil → First postgraduate Program in Computer Engineering
- Pioneer in University of Pernambuco (UPE) → First postgraduate Program at Polytechnic School of Pernambuco (POLI)
- Additional information:
  - First M.Sc. thesis viva → May, 2008
  - Over 90 M.Sc. Thesis approved until July, 2014
  - 40 M.Sc. Students currently enrolled
- Target: a joint PhD Program by 2014

# ***PPG-EC – General Information***

- <http://mestrado.ecomp.poli.br/>
- 17 Professors
- Main knowledge areas
  - Computer Engineering
  - Computer Science
  - Information Systems
- Main research lines:
  - Computational Intelligence
  - Software Engineering

# *Main topics researched at PPG-EC*

- Novel metaheuristics for solving real world problems
- Social Simulation & Stochastic Modeling
- Pattern recognition & Machine Learning
- Frameworks, Domain Specific Languages & Tools
- Requirements and Software Engineering

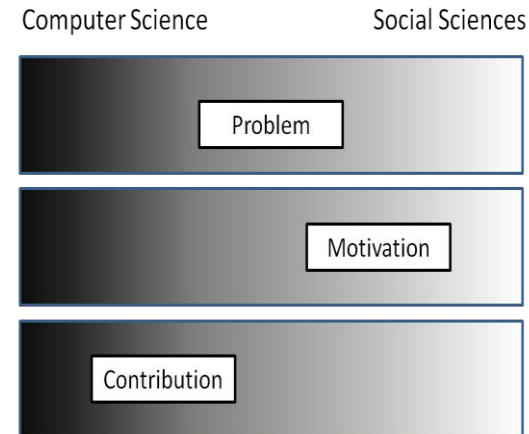
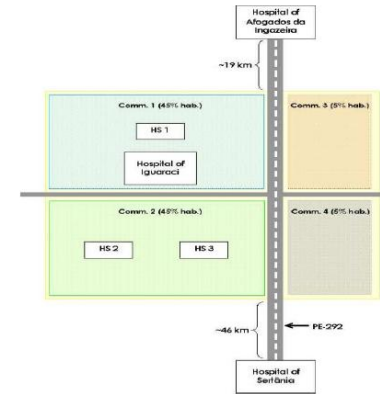
# ***Novel metaheuristics for solving real world problems***



- Novel naturally metaheuristics
  - .Fish School Search
  - .Wolf Pack Approximation
- Development of novel operators and communications schema for Swarm based Algorithms
  - .ABeePSO / VolitivePSO / ClanPSO
- Robust classifiers for Pattern Recognition
- Training Adaboost by Swarm Intelligence and Evolutionary Computation
- Metrics for assessing Swarm Algorithms
  - .DFT over the Laplacian Matrix
  - .Analysis of the Influence Matrix
- Multi-modal, Multi-objective and Many-objective optimization
  - .dFSS / .MOPSO-CDR / MOPSO-CDRS / MOPSO-GDR / MOPSO-DFR
- Swarm Intelligence for training classifiers applied for forecasting

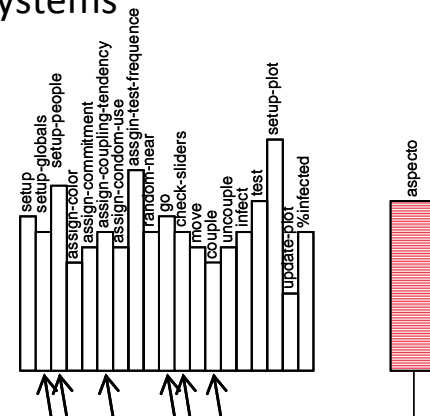
# Social Simulation & Stochastic Modeling

- Study and development of new computational approaches with multiples simultaneous evolutionary capabilities (symbolic or sub-symbolic);
- Cybernetic approach is used for taking advantage of distributed intelligence with several levels of retro-feedback and nature (e.g. memetic and genetic);
- Examples of researches output:
  - 1) return migration and trans-generational migration (collaboration with FUNDAJ, Brazil – Federal Social Science Institute);
  - 2) negative taxation models (collaboration with KIT – Karlsruhe Institute of Technology, Germany);
  - 3) multi-layer evolutionary logistic models (collaboration with University of Münster, Germany); and,
  - 4) better understanding of history by using network science on intelligent data mining (collaboration with FIT – Florida Institute of Technology, USA).



# Frameworks, Domain Specific Languages & Tools

- Study and development of new highly specialized applied components for hard problem domains;
- Semiotic approach is used for taking advantage of multi-perspective, subjective representation and *ad hoc* usage;
- Examples of researches output:
  - 1) Framework for Social Simulation Using Aspect Oriented Approach
  - 2) Aspect-Oriented Modeling for Multi-agent Systems in Social Simulation
  - 3) Wizard for Generating Social Simulations
  - 4) Context sensitive ICU Interfaces based on principles of computational semiotics
  - 5) Application of Semiotic and Cybernetic principles in Decision Support Systems



# *Requirements and Software Engineering*

REQUIREMENTS  
ENGINEERING

SOFTWARE  
REUSE

MODEL DRIVEN  
DEVELOPMENT

ASPECT  
ORIENTED  
DEVELOPMENT

AGENT  
ORIENTED  
DEVELOPMENT



# ***Pattern recognition & Machine Learning***



## **Machine Learning**

- Classification
- Data Mining
- Evolutionary Computation
- Feature Selection/Construction
- Kernel Methods
- Learning Preferences or Rankings
- Neural Networks
- Reinforcement Learning
- Semi-Supervised/Unsupervised Learning
- Time-series/Data Streams
- Markov Decisions Processes
- Hybrid Systems

## **Pattern recognition topics:**

- Document analysis and processing
- Text recognition and classification
- Medical image analysis

- Wind forecast
- Inflow forecast
- Speech Recognition and Understanding
- Face recognition
- Gesture recognition

## **Robotics and Vision**

- Vision and Perception
- Motion and Path Planning
- Manipulation

## **Knowledge-based Information Systems**

- Information Extraction
- Knowledge Acquisition
- Knowledge-based Systems
- Recommender Systems

## **Image and video processing**

# ***Current External Collaborations***

- University of Johannesburg (UJ) - SOUTH AFRICA  
Faculty of Engineering and the Built Environment
- University of Pretoria (UP) - SOUTH AFRICA  
Computational Intelligence Research Group
- National Institute of Technology (NIT) - INDIA  
Department of Mathematics
- Florida Institute of Technology (FIT)  
Computer Science Department
- University of Münster (WWU) - GERMANY  
European Research Center for Information Systems (ERCIS) - Chair of Information Systems and Logistics
- University of Duisburg-Essen - GERMANY  
Faculty of Engineering - Institute for Nano Structures and Technology (NST)
- Karlsruher Institute of Technology (KIT) - GERMANY  
Institute of Applied Informatics and Formal Description Methods (AIFB); Chair of Public Finance and Public Management;  
Rectory Department for Quality Management
- City University London - ENGLAND  
School of Informatics - Department of Computing
- Heriot-Watt University - SCOTLAND  
School of Mathematical and Computer Science
- University of Vienna - AUSTRIA  
Faculty of Computer Science - Research Lab. Computational Tech.and Applications
- INRIA - FRANCE  
Contraintes group (Paris-Rocquencourt)
- Peking University - CHINA  
School of Electronic Eng. and Computer Science - Computational Intelligence Laboratory (CIL)



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*Many thanks !*

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