

# EVANNAI

EVOLUTIONARY  
COMPUTATION AND  
NEURAL NETWORKS

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*Automatic driving of vehicles*

Evolutionary Computation and Neural Networks (EVANNAI), led by Dr. Pedro Isasi Viñuela, is formed by a team that carries out basic and applied research in the fields of evolutionary computation and data mining/machine learning. The group uses evolutionary computation techniques (genetic algorithms, evolution strategies, particle swarms, ...) to solve optimization problems and to deal with typical tasks of data mining, such as classification, time series prediction, clustering, relevant variable selection, etc.

The group develops extensive research work funded by research projects which has been reflected in many publications, conference contributions, doctoral theses, etc. EVANNAI collaborates with diverse research groups both nationally and internationally and its members regularly participate in organizing special sessions in some of the most prestigious international conferences.

## • RESEARCH LINES •

- Bioinspired Computation: Genetic Algorithms, Evolution Strategies, Genetic Programming, Particle Swarms, among others.
- Multi-Objective optimization.
- Data Mining/Machine Learning.
- Artificial Neural Networks.



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## • OUTSTANDING COLLABORATIONS AND R&D&I PROJECTS •

EVANNAI regularly collaborates with national and international research groups. In the scope of national collaboration, they have worked with the NEO group of the Universidad de Málaga, the Arco group of the Universidad de Extremadura and the Paralelismo group of the Universidad de La Laguna. EVANNAI has been working with these research groups in coordinated projects since the year 2002. Likewise, EVANNAI belongs to the National Data Mining Network and the National Time Series Network.

In the context of international collaboration, EVANNAI collaborates with the Indian Institute of Technology Kanpur, the Université des Sciences et Technologies de Lille (France) and Stockholm University (Sweden).

The main clients of the group include IBERDROLA, IBERMÁTICA, UNIÓN FENOSA and TELEFÓNICA.



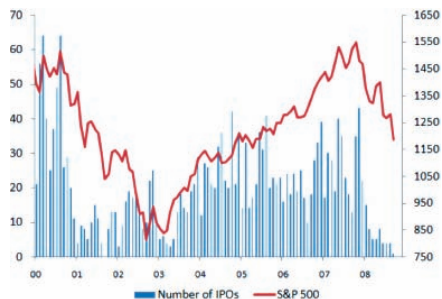
Robot AIBO

The members of EVANNAI have worked in a number of funded projects. The most noteworthy and recent projects are the following:

- MSTAR (Multiobjective Metaheuristic and Multidiscipline Applications): Development of multiobjective optimization algorithms based on metaheuristics and application to multidisciplinary domains.

*Funding Entity: Ministry of Science and Education. Date: 2008-2011*

- **eInkPLUSPLUS** Hardware and Software Platform for accessing Digital Contents by means of Electronic Ink.  
*Funding Entity: Ministry of Industry, Trade and Tourism. Date: 2009 -2012*
- **OPLINK** (Net-Centric Optimization): Application of metaheuristics to solve telecommunications problems.  
*Funding Entity: Ministry of Science and Education. Date: 2005-2008*
- **TRACER** (Advanced Optimization Techniques for Complex Problems). Development of new metaheuristic algorithms and application to complex optimization problems (combined optimization, code correctors, charge distribution in a sphere, ...).  
*Funding Entity: Ministry of Science and Education. Date: 2002-2005*
- **ML-BCI** (Machine Learning for Brain Computer Interface). Development of a BCI system and classification techniques to improve the precision of the BCI screen.  
*Funding Entity: Community of Madrid. Date: 2008*



*Economy and finance: Prediction*

- **CEC-MP** (Evolutionary Computation for Classification of Data Mining).  
*Funding Entity: Community of Madrid. Date: 2007*
- **CibMin** (Bioinspired Computation for Data Mining).  
*Funding Entity: Community of Madrid. Date: 2006*
- **OE-FIN** (Evolutionary Optimisation for Financial Assets Management).  
*Funding Entity: Community of Madrid. Date: 2010*

## • FIELDS OF APPLICATION •

The group has applied both the new algorithms as well as the standard techniques in various fields of application which are usually funded by competitively obtained projects. Specifically, EVANNAI has worked in the following applied areas:

- **Data Structures.** Automatic Design of hash functions with AI techniques.
- **Telecommunication systems optimization.** Evolutionary and metaheuristic techniques have been used to optimize various components of telecommunication systems. Specifically, frequency assignment problems for GSM, the optimal placement of antennas and the determination of protocol parameters in MANETS networks have been dealt with.
- **Robotics.** Optimization of AIBO mobility.
- **Economy and Finance.** Problems of Initial Public Offerings (IPO) relating to public stock listing of new companies and opti-

mal policies for Ausubel-type ascending auctions with package bidding have been widely dealt with.

- **Brain Computer Interface.** This is a classification problem. Various techniques have been applied to overcome problems with multiple classes and the optimization of spatial filters for signal preprocessing.
- **Games.** Evolutionary techniques and machine learning have been used to optimize the functions of players in the Robosoccer and automatic driving domains.

### • INNOVATIVE TECHNOLOGICAL SOLUTIONS •

- System for the efficient control of electric and chemical plants.
- Consumer market segmentation tool.

- Artificial intelligence software for data optimization, prediction and analysis.



*Rack*

### • TECHNOLOGICAL EQUIPMENT •

The group now has two main groups of machines exclusively dedicated to research works and projects. These machines are in the facilities of the Computation Center at

Universidad Carlos III of Madrid and the Computer Science Department. Said group of servers is formed by:

- 2 DELL Windows 2003 Equipment with 4 and 8 cores.
- 1 DELL Precision R5400 (Windows Vista Ultimate) Equipment with 8 cores.
- 1 SUN 4440 Equipment with 16 cores (Windows 2008 server).
- 2 DELL Blade Linux RedHat Equipment with 4 cores.
- 4 MAC Xserve Servers with 8 cores.
- Shared bulk memory storage unit.

The group's laboratory has the TEAM cluster of 4 double nuclei PC, as well as four PC and HP Laserjet 4650 DN printer to be used by students and fellows of the group.

The group also has an 8 channel EEG/ERP V-AMP Brainvision acquisition system.

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# EVANNAI

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IMAGE OF COVER: *Vegetable inside. Ángel Febrero.*