

# 69<sup>th</sup> ESGI

## EUROPEAN STUDY GROUPS WITH INDUSTRY IN PORTUGAL

20<sup>th</sup> - 24<sup>th</sup> April 2009

Universidade de Coimbra

[www.mat.uc.pt/esgi69/](http://www.mat.uc.pt/esgi69/)



# PT MATHS IN

rede portuguesa  
de matemática  
para a indústria  
e inovação

## working groups

### CHALLENGE 1

#### Estimating the price elasticity of water

industry\_ **AdP - Águas de Portugal**  
sector\_ **Water Supply**



Setting the price of water on a public distribution network taking into account fixed and operational costs might not be sufficient. This is due to the fact that once prices are raised water demand may decrease, since consumers will either restrict their water intake or even consider alternative water suppliers.

The problem is how to estimate the price elasticity of water, that is, the dependence of demand on price, so that this factor can also be taken into consideration.

The problem is indeed complex, with important site specific social and cultural variables not easily to assess accurately. Consequently, if there is insufficient data to support the development of a predictive tool, the approach could be thought in terms of a "learning methodology":

- Initially, a data base will be created with information collected from companies' routine operations. This task would include the identification of the critical variables, as well as data base design.
- Subsequently, as data base grows in size, useful information will be produced to give insights on how the users are behaving / reacting.
- At that stage, the tool can play the role of a early warning system to the company's manager (i.e, How are clients responding to the last raise in water price? Are company's goals easier to achieve with last year's price?)
- At a later stage, as the variables and their interdependence become (empirically / statistically) clear, the tool will hopefully play a predictive role.

### CHALLENGE 2

#### Fraud detection in plastic card operations

industry\_ **SIBS**

sector\_ **Financial Services**



There are several million plastic card operations per day which are monitored by SIBS with the purpose of detecting fraudulent usage. On a first level, an application which was developed in-house has an algorithm, based on a set of rules, which validates about 98.9% of all transactions. The remaining ones go through a sequence of human processes which bring this number down substantially, and decide what form of action should be taken.

The problem proposed by SIBS is to include an extra automated filter to ease the load on the human side of the process. This should be accomplished by a neural algorithm that can be thought to identify behavior patterns and the respective deviations and subsequently discard or alert a more accurate number of fraudulent transactions.

### CHALLENGE 3

#### Optimizing a complex hydroelectric cascade in electricity market

industry\_ **REN**

sector\_ **Energy**



In the case of reversible hydroelectric power stations it is possible to bring water from a downstream reservoir to an upstream one. This is usually desirable at times of low demand, in order to be able to produce energy during peak hours. While this might not be worthwhile from an energy point of view, the fact that the price of electricity varies throughout the day makes it possible to use cheaper energy to produce energy at future times when it will be more expensive.

While in the case of one single power station the solution of the problem is more or less straightforward (pump up the water during low-demand hours where electricity prices are also low), it becomes more complex in the case of a system of power stations in a cascade configuration with the possibility of pump water from one reservoir to two reservoirs.

### CHALLENGE 4

#### Reliability of a customer relationship management

industry\_ **Critical Software**  
sector\_ **IT and Software**



The Customer Relationship Management (CRM) system is the entry point for business capture information. The information contained in the CRM system is spread out through all the organization for planning purposes. A deep understanding on the confidence level of the business forecast would ease the planning processes and activities. CSW has the following two main goals:

- Answer to the following questions:
  - What's the confidence level of the success probability by market, business developer and type of business?
  - What's the confidence level of the expected close data by market, business developer and type of business?
- An algorithm or learning mechanism (system or specification) that could be applied to the CMR system and continuously learn and monitor the business pipeline.

### CHALLENGE 5

#### Management of stock surplus

industry\_ **Sonae Distribuição**  
sector\_ **Retail and Distribution**



The retail business of Sonae Distribuição is characterized by wide range of products in stores operated by teams trained in the best practices of care and customer service. Throughout the country, the stores offer products ranging from basic food to textiles or mobile telecommunication devices.

Engage in a policy of aggressive price, based on varied and intense promotional activity, the daily requirement for submission of products to its customers in some cases causes a surplus of stock which must be treated properly.

However the life of various items are increasingly short on time and subject to fashions or trends, which can generate a broad spectrum of items that are wrong in terms of supply to customers.

The seasonality of supply specified in textiles, together with weather conditions, may also become a source of surplus stock to be treated. The problem is presented focused on the following concerns :

- How to deal with surplus stock of normal commercial activity generated by the different stores?
- What criteria should be followed in deciding to collect of goods or simply "eliminate" goods?
- To what extent the distance, the number of stores or type of stores should be taken into account?
- How to relate the decision with the type of item or its cost?

## sponsors



ECMI EUROPEAN CONSORTIUM FOR MATHEMATICS IN INDUSTRY



CMUC Centre for Mathematics University of Coimbra



ϕ|μ Grupo de Física Matemática da Universidade de Lisboa

