Combining Soft Computing and Statistical Methods to Improve Data Analysis Solutions

IC0702

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Year: 1

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Chair

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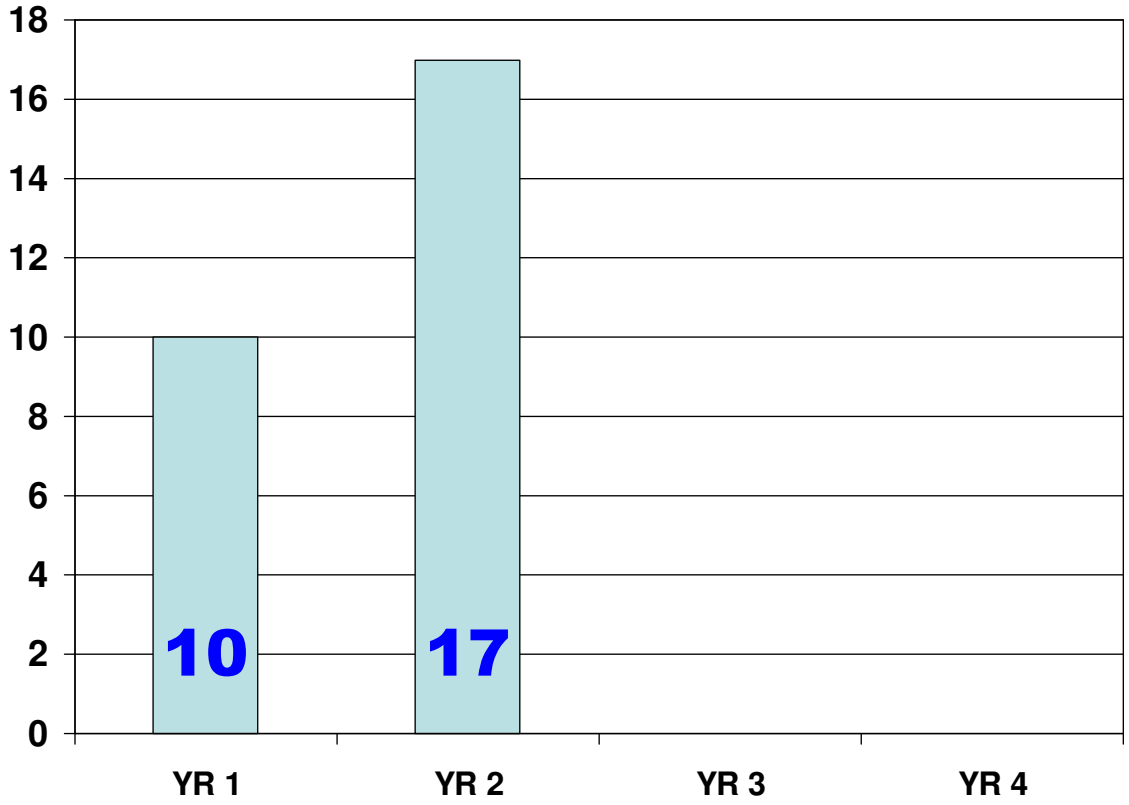
Action Parties



Grant Holder:

European Centre for Soft Computing

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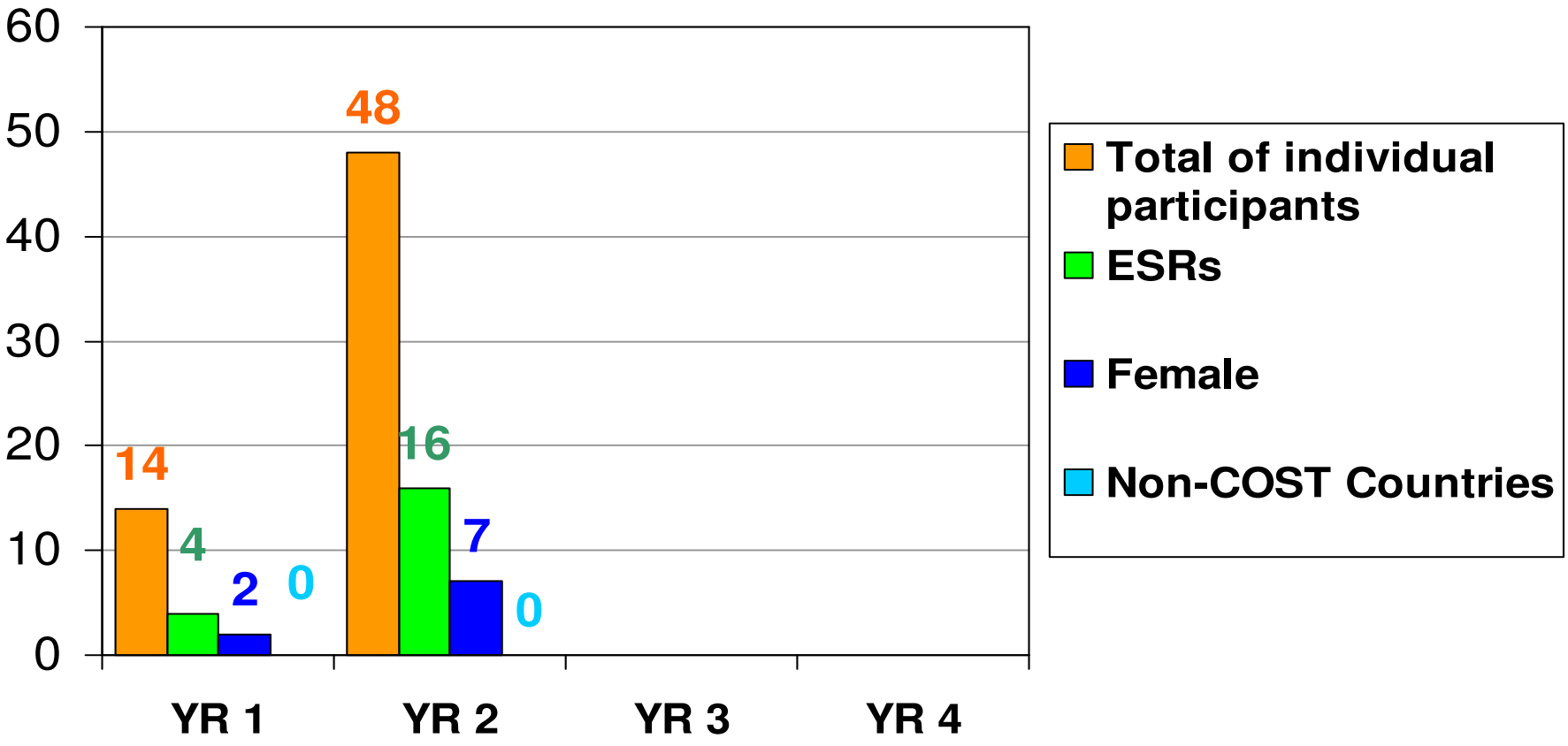
Action participants



Use of COST instruments

	YR 1	YR 2	YR 3	YR 4
No. of MC / WG meetings	2 (3)	(2)		
No. of STSMs	9	(15)		
No. of workshops / conferences	1	1		
No. of joint publications	0 (8)	(12-15)		
No. of training schools	1	1		
GASG (activities)	posters, website	posters, website		

Scientific context and objectives (1/2)

- Soft Computing, as an engineering science, and Statistics, as a classical branch of mathematics, emphasize different aspects of data analysis
- **Soft Computing**
  focuses on quickly obtaining working solutions that meet the needs arising in applications.
- **Statistics**
  focuses on establishing objective conclusions by rigorously analyzing all possible situations.
- Improving the currently rather limited dialogue and interaction between these areas can lead to new and improved data analysis methods.

Scientific context and objectives (2/2)

- **Soft Computing Methods and Models**
  - often lack sound mathematical foundations,
  - rarely make their underlying assumptions explicit, thus impeding a reliable transfer to new applications.
  - are seldom checked rigorously and monitored w.r.t. performance and robustness,
  - can rarely be generalized or easily transferred
- **Statistical Methods and Models**
  - tend to focus on models, the mathematical properties of which are easy to analyze,
  - constrain the set of eligible models, thus perhaps ruling out the most suitable or promising ones,
  - can be difficult to understand or apply for a non-mathematician.

Working groups

- Working Group A
  Model Selection and Validation
  - Statistical validation and monitoring of Soft Computing models
  - Model selection and validation for neural networks

- Working Group B
  Bio-inspired Metaheuristics
  - Metaheuristics (evolutionary algorithms in particular) as Estimators
  - Estimation of distribution algorithms

- Working Group C
  Statistics with Imperfect and Incomplete Data
  - Statistics with fuzzy data (estimation and regression)
  - Psychological versus statistical complexity

Results vs. Objectives

- Gather researchers from soft computing and statistics in working groups, stimulate exchange and discussion.
  (successfully achieved: presentations triggered animated discussions)
- Execute short term scientific missions, preferably between a statistics host and a soft computing visitor or vice versa.
  (more or less achieved: bridging the gap is difficult)
- Organize training schools to disseminate statistical and soft computing knowledge and successful joint applications.
  (successfully achieved: spring school and summer course)
- Apply for new research projects in which statisticians and soft computing researchers work togetherand develop new data analysis methods.
  (not achieved yet: progress to this goal is slower than hoped for)

Significant highlights (1/2)

- Spring School "**Reasoning and Decision Making under Uncertainty and Imprecision**"
  May 18-20, 2009
  European Centre for Soft Computing, Mieres, Spain
  http://www.cost-ic0702.org/springschool/
- Topics: Soft Computing, Statistics, Logic, Decision Theory
- 15 high-level lecturers from 8 countries,
  > 35 participants (early stage researchers) from 10 countries.
- Organized jointly with COST Actions IC0602 and IC0801.
- Initiated a closer cooperation between COST Actions IC0702, IC0602 and IC0801, which will be continued.

Significant highlights (2/2)

- Only one short-term scientific mission less than planned.
- Topics cover mainly three research areas:
  - information retrieval
    novelty detection, summarization, topic detection/tracking
  - statistics with fuzzy data
    hypothesis tests with imperfect data, linear regression with imprecise response, robust fuzzy regression
  - knowledge discovery in complex and structured domains
    stream mining, change mining, spatial data analysis, feature selection
- For already completed STSMs draft research papers are available and will be submitted in the course of this year.
- Noteworthy STSM: “A Determination Coefficient for a Linear Regression Model with Imprecise Response“

Challenges

- We planned to achieve or at least get closer to the goal of compiling and submitting a research proposal in the area of soft computing and statistics.
- Progress towards this goal has been slower than hoped for, because the exchange about the research areas of the working group members took longer than expected.
- A subgroup has formed in working group C, which works towards a project application in fuzzy statistics. The challenge is to actually reach a project proposal.
- Second core challenge: maintain and improve the success of the short-term scientific missions.