MULTI-MODEL AND PERVERSIVE INTELLIGENT DECISION SUPPORT SYSTEM FOR UNIVERSITY APPLICATION

Tiago Magalhães, Filipe Portela, Manuel Filipe Santos
Algoritmi Center, Information System Department, University of Minho, Azurém, Guimarães, Portugal
Introduction

Higher Education

- Portuguese Higher Education
  - National Admission for Accessing Higher Education

Decision Support System – C.U.R.S.O.

- Description
- Data Model
- Architecture

Conclusion & Future Work
This work has focused on how it would be possible to build a Decision Support System (DSS) that could support the decision of which Higher Course to ingress.

It is a sequence of an experimental phase where it was introduced as Decision Support System called C.U.R.S.O. (Universal Centre Collection Tips Oriented).

C.U.R.S.O. assisted the students who are in transition year between secondary and higher education, in order to choose the most suitable course for them according their profile.

The success of this first version using only a few numbers of variables motivated the improvement of the decision models and system.
In this second stage, the DSS was rebuilt and improved, using an upgraded and updated Decision Model adapted for the Portugal reality.

The resulting DSS was built with the purpose of being model-independent, for possible adaptability to other countries’ reality.

The supporting architecture was structured in four functional and open subsystems, providing ways of communication between the subsystems.

Intelligent Agents were incorporated into the architecture in order to automate several tasks needed to power the system, making it an Intelligent Decision Support System (IDSS).
PORTUGUESE HIGHER EDUCATION

PHEI Taxonomy

Portuguese Higher Education Institutions

Public Higher Education Institutions

Private Higher Education Institutions

Access Ways

Nation Admission for Accessing Higher Education (NAAHE)

Local Concourses

Institutional Concourses
NATION ADMISSION FOR ACCESSING HIGHER EDUCATION – REQUIREMENTS

1. Holding a High School Degree or Equivalent

2. Have completed within the two years preceding the admission year, the national exams that will serve as ingress exams required for each course and Higher Education Institute (HEI);

3. Perform the prerequisites, if required for a specific course.
NATION ADMISSION FOR ACCESSING HIGHER EDUCATION – ADMISSION PROCESS

1. **Application Grades** must be higher than the minimum set by every HEI for each course.

2. **Apply to maximum of six tuples Institution/Course** in order of preference.

3. **Applicants are placed through three phases**, having in mind Application grade and the tuple’s position.
Implementation of the Simon’s Model

Questions grouped in Logic Blocks (LB’s)

Introduce Logic Blocks Weighing
This IDSS follows the Simon’s Model for DSS, composed by five stages.

1. Intelligence
2. Design
3. Choice
4. Implementation
5. Monitoring

First three stages as already completed, having as output, an updated and valid Data Model.
- Appended Tables to the IDSS but with no relationship to the Data Model.

- It holds the information about the questions and the Logic Blocks.
ARCHITECTURE
ARCHITECTURE

- **Adaptive and Optimized models** — the Models can be adapted and optimized to reflect the recurring changes that affect the Higher Education Application Process.

- **Online-learning** — the system learns from the inputs of the user in the various questionnaires, this process should be executed in real-time.

- **Flexible number of outputs** — there are various outputs in every end of the questionnaire to ensure a set of situations that could be covered.
ARCHITECTURE

- **Customization made by the user** – the user can personalize his experience and results, removing logic blocks from the algorithm.

- **Accommodation of new variables or LBs** – as the Models can be updated; therefore new variables can be added to the system and the logic blocks rearranged.

- **Real-Time processing** – the data inserted during the questionnaire is stored in the moment to ensure a processing in real-time to ensure a result in the moment.
ARCHITECTURE

- **Universality** – the system is designed in a way that can easily include alternative models, customized for other countries.

- **Pervasiveness** – to use the system and interact with it, the only requirement is a web browser running in a tablet or Smartphone.

- **Interoperability**. The separate systems presented on the architecture, everyone with its specification ensures a challenge to promote a harmonious interoperability in the system.
DB Server hosts the needed Data for the System

- Data includes Institutions, Degrees and Metrics

- Yearly Updates to keep the Model accurate as possible.
Initiation of the Decision Model and the Inference Database, in order to receive the data for the questions and to the Data Model.
ARCHITECTURE - INFERENCE

- **Distribution** of the **Information** present in the **Inference DB** and the **Decision Model**
- **Structure** the **Questions** and formulate the **Inference Rules**
ARCHITECTURE - INTERFACE

- The only subsystem the user accesses via a Web Browser
- Information managed by the Interface Agent, that handles the right information to show, in a responsively way.
- Answers Weights stored in a DB for future review of past quizzes.
This architecture is supported by an agent based system, composed by several semi-autonomous agents in charge for the functionalities inherent to the system.

Formally, the system is defined as a tuple:

\[ \Xi = < \text{CURSO}_c, \text{CURSO}_\Delta, a_{dp}, a_{mi}, a_{dr}, a_{ir}, a_{out}, a_{qe}, a_{asw}, a_{int} > \]
INTELLIGENT AGENTS

- **Data Load Subsystem**
  - **Data Processing Agent** ($a_{dp}$) – This agent processes the data from the various Data Sources and prepares them for the Data Model and Inference DB.

- **Knowledge Management Subsystem**
  - **Model Initiation Agent** ($a_{mi}$) – This agent initiates the Model to ensure that the Data Model can receive the data.
Inference Subsystem

- Data Retrieval Agent ($a_{dr}$) – This agent retrieves the Data Model data to feed it to the Questions DB and Weights DB (to store the default weights).

- Inference Retrieval Agent ($a_{ir}$) – This agent transforms the Data from the Inference DB to the Questions DB and prepare it to be used on the Interface. It also sets the rules for the final results at the end of the questionnaire.

- Output Agent ($a_{out}$) – This agent is responsible for giving to the user the result of the inference.

- Questions Evaluation Agent ($a_{qe}$) – This Agent sees if the Questions correspond to the Data present in the Inference DB.
Interface Subsystem

- **Answers Agent** \( (a_{asw}) \) – This agent stores the users’ answers into a DB for a further analysis (crucial to the output calculus).

- **Interface Agent** \( (a_{int}) \) – This agent interacts with the user, facilitating a data analysis by the users.
The architecture proposed, characterized by pervasiveness, adaptability and flexibility, constitutes a platform that can be used in a large quantity of situations and contexts and transposed to other countries without losing its core. This work proved the viability of having a multi-model platform prepared to accommodate different types of decision models, without compromising the complexity of the real life application process. This reflects in a substantial architecture where every factor, input and output are taught with precision and can fit distinct processes in other countries/counties with minimal changes.
FUTURE WORK

- Deployment of the IDSS using the models presented.
- Incorporation of a Monitoring process in order to receive the users’ (students) feedback.
- This feedback can be used to enrich the models and adapt the IDSS.
- Complementarily, a Business Intelligence platform will be developed in order to make some important indicators about the students available to the schools and to the application process.
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THANK YOU!

QUESTIONS?

Please send the questions to Filipe Portela - cfp@dsi.uminho.pt