Analysing the Low Quality of the Data in Lighting Control Systems

Syllabus

- ✓ Motivation
- ✓ Improving the energy efficiency in lighting systems
- ✓ Experiments with light sensors
- ✓ Conclusions and future work

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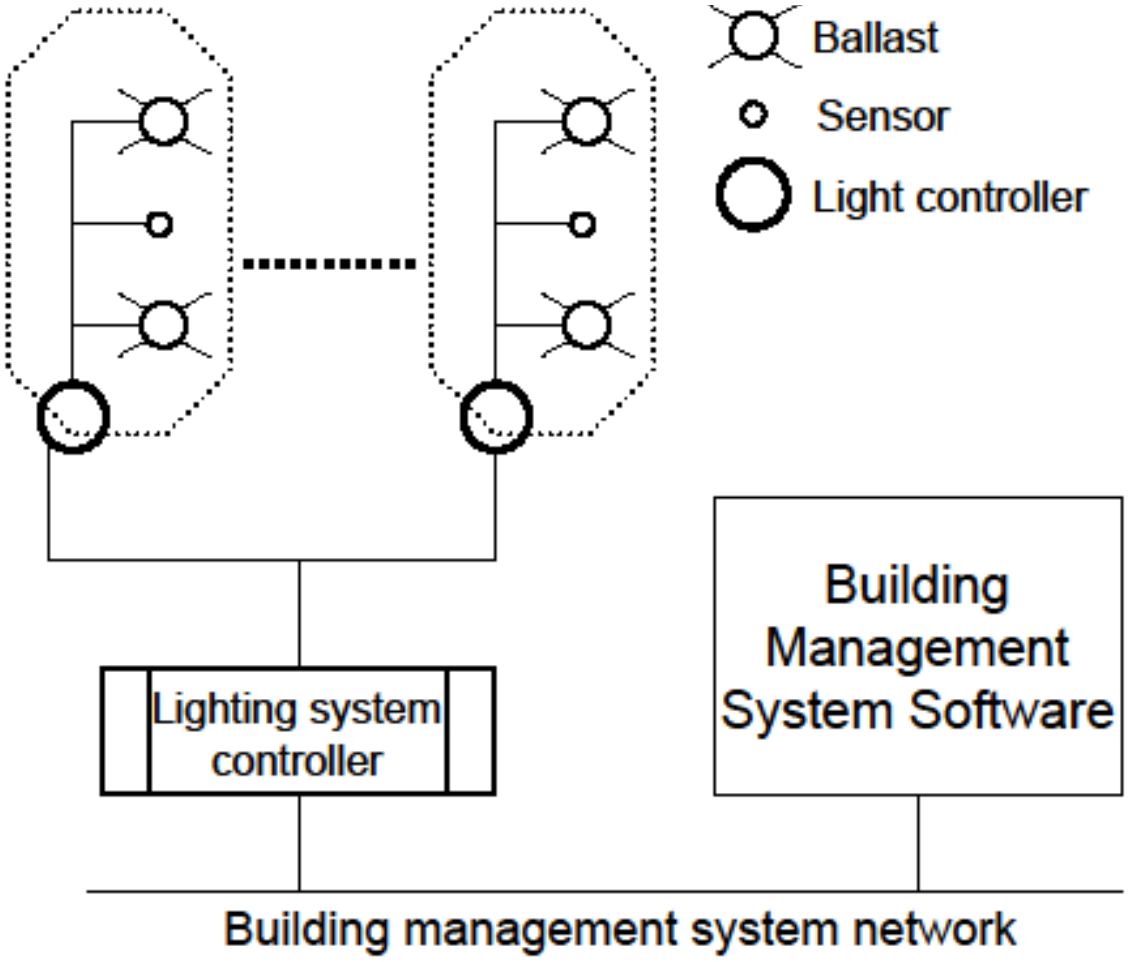
Motivations

- As it is known, the main part of the literature deals with modeling with crisp data.
  - Sensors and meta-information
- The lack of the meta-information management in processes and data sets:
  - Non stocastic noise and precision of the sensors
  - Ambient intelligence and user profiles
- Regarding this meta-information could improve the models used in simulation or energy distribution
- The analisys of a lighting control system ilustrates the lack of using meta-information.

Improving the energy eficiency in lighting systems (LSs)



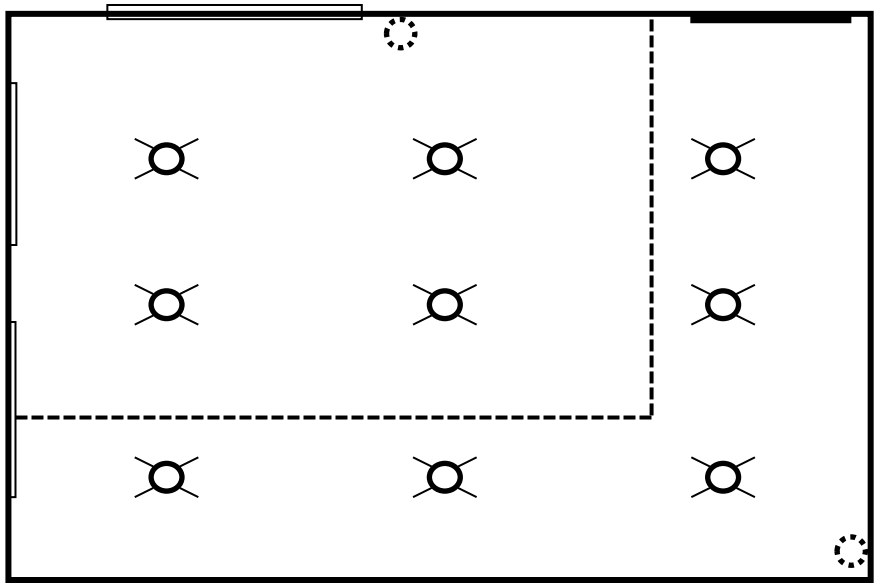
Models for simulation of LSs

Improving the control decision in lighting

Computer assisted decision making

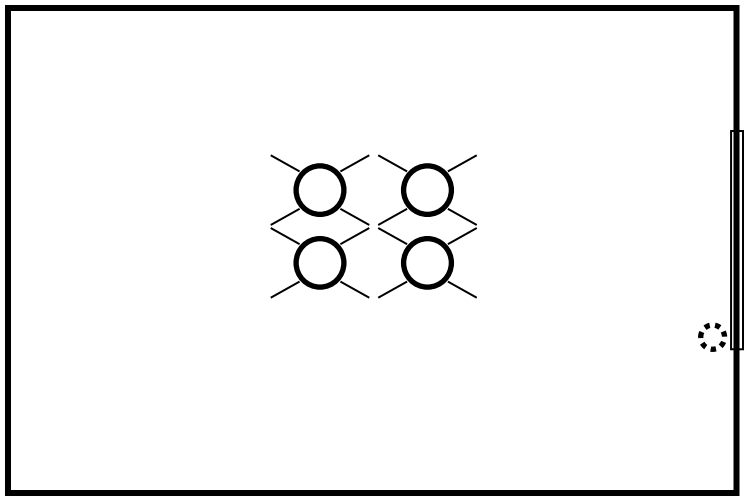
Case of study: simulation of LS

- **Objectives**
  - Simulating the light sensors output when a certain lighting power is applied.
    - Two scenes with a light sensor in each, the aim is to obtain the best controller



Experimenting with light sensors

- A simple 3x4 m room with one light sensor (LDR) at 3 mts height, with a non-automatized blind.

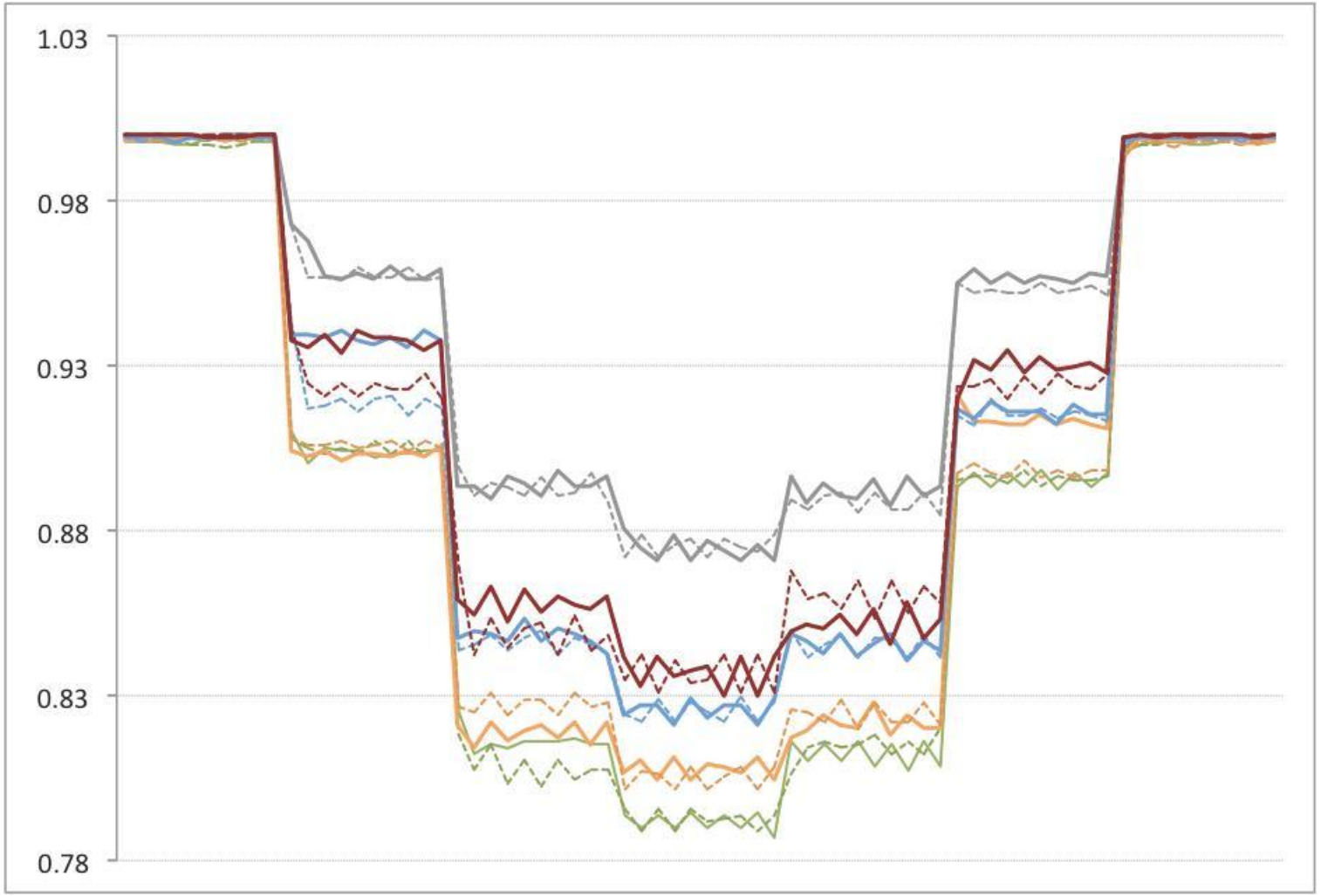


With the arduino and a 0-10Vcc light controller/regulator

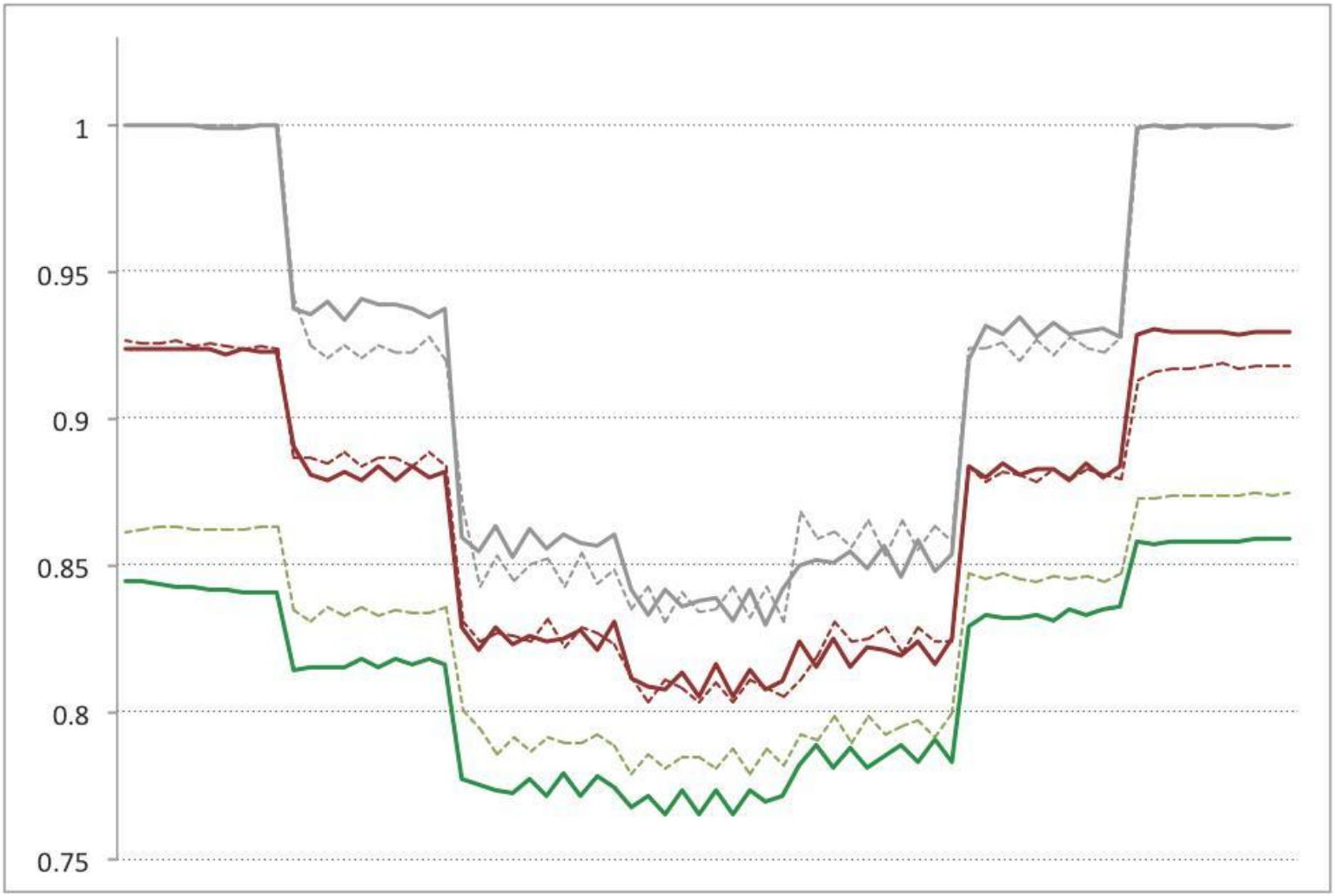
- Regulation steps: 0%, 33%, 66% and 100% of installed power.
- The blind could be opened, closed or half closed

Experiment 1: Step response of the light sensor output with the blind closed varying the lighting power.
Experiment 2: Step response of the light sensor output varying the lighting power and the blind state.

Experiment 1



Experiment 2

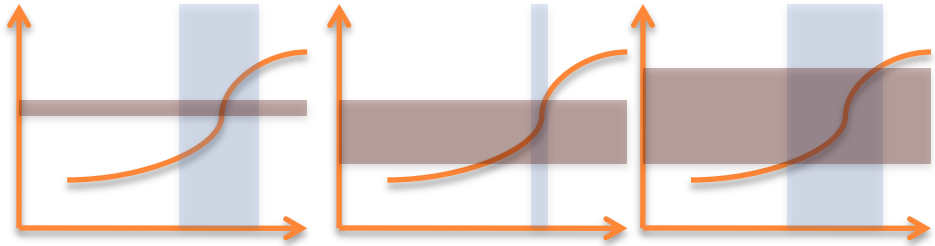


Conclusions and future work

- There is an evidence that light controllers do not consider the data measured by the sensors: neither the noise in the measurements nor the sensor dependence.
- If low quality data is included in obtaining the models of the sensors, the controllers would be robust to such variability.
- One possible method to manage the low quality data is extending the GFS to manage fuzzy data as proposed by L. Sanchez et al.
  - L. Sanchez, I. Couso, J. and Casillas.*Genetic Learning of Fuzzy Rules based on Low Quality Data*. **Fuzzy Sets and Systems** (2009)
  - L. Sánchez, J. Otero and I. Couso. *Obtaining linguistic fuzzy rule-based regression models from imprecise data with multiobjective genetic algorithms*. **Soft Computing** 13:5 (2008) 467-479.

Current work and design decisions

- L. Sánchez, J. Otero and I. Couso. *Obtaining linguistic fuzzy rule-based regression models from imprecise data with multiobjective genetic algorithms*. **Soft Computing** 13:5 (2008) 467-479.
  - Total order
  - Fuzzy fitness
  - Rule learning: GCCRL schema



- Luciano Sánchez and José R. Villar. *Obtaining transparent models of chaotic systems with multiobjective simulated annealing algorithms*. **Information Sciences** 4 (2008) 952-970.

Search for the equations of the model using GAP:

- the SAP and MOSAP algorithms
- Fuzzy numbers as constants
- or Fuzzy models and rule learning

A total order relationship could not be needed.

Two complete two-scenes laboratories for testing and validating models

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Thank you

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