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Metrics to Rank Illegal Buildings

IARIA

Paolino DI FELICE

paolino.difelice@univaq.it

0000-0003-3552-0199

Dep. of Industrial & Information Engineering & Economics
University of L'Aquila, L'Aquila (ITALY)

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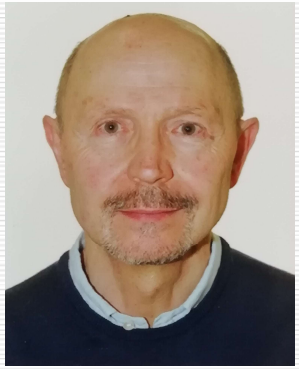
University of L'Aquila, L'Aquila (ITALY)



This is me

Current research interests:

- *Ranking Strategies;*
- *Informative Marketing;*
- *Model-driven Engineering;*
- *Automatic Code Generation of MVC Web applications;*
- *Quality Metrics;*
- *Metadata Repository;*
- *Reuse of UML Artifacts;*

PRELIMINARY CONSIDERATIONS

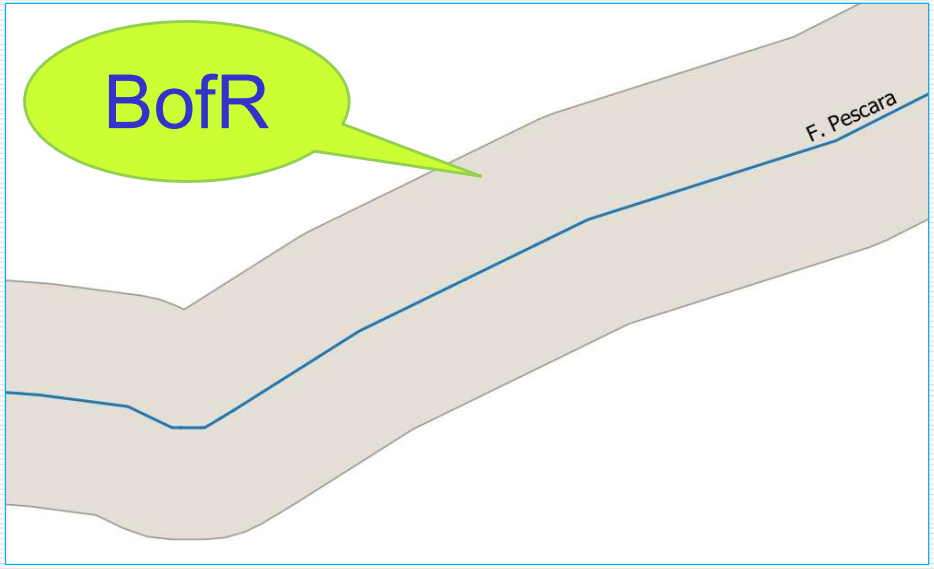
An image of the flood of Florence (1966)

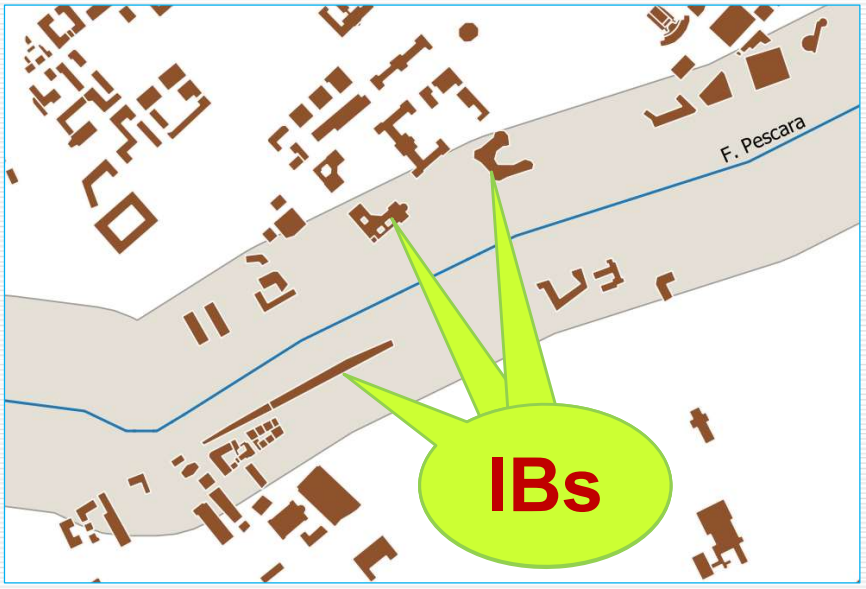
PRELIMINARY CONSIDERATIONS (1)

The Italian **Law** n.**42** (Jan., 2004).

Art.142:

fixes in 150m (both sides) the width of the **B**and **of R**espect around rivers.





SPEECH'S OUTLINE

- ✓ Problem relevance
- ✓ Definitions/notations
- ✓ Metrics to rank IBs
- ✓ Implementation of the theory
  - The software architecture
  - The underlying SDB
- ✓ Law S-580 B

RELATED WORK

Lugeri et al. (2010):

"*in the near future in Europe the risk of flooding will increase*."

To limit tragic events:

A. urban planning has to take into account this increasing danger;

B. **increase** the severity of actions against IBs (discourage building in rivers' basin).

The phenomenon of IBs

… dramatic in developing countries,

… an unsolved issue in advanced States.

Fight the IBs phenomenon:

- ✓ **punish** law's violations;
- ✓ **protect** people's lives;
- ✓ **stop** landscape's destruction.

DATA ABOUT ITALY

LegAmbiente's nation-wide studies

2007:

Period covered: 1994 - 2003

Total # of IBs: **400K**

2018:

Period covered: 2005 - 2018

2004: the last building amnesty

Total # of registered infringements: **57K**

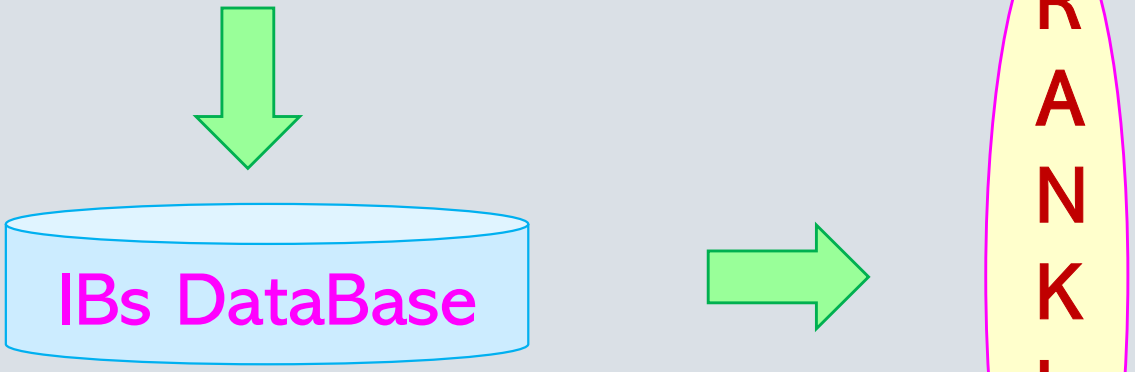
RELATED WORK (5)

Protection of environment/people

demolition

the challenge of IBs

Remote sensing methods



DEFINITIONS & NOTATIONS

GeoArea; <description, geometry>

$\mathcal{C} = \{c_q \ (q=1, 2, Card(\mathcal{C}))\}$

<ID, elevation, geometry>

$\mathcal{R} = \{r_k \ (k=1, 2, Card(\mathcal{R}))\}$

<ID, name, geometry>

RiverBuffer(r_k) $\Leftrightarrow$ *BofR*

$\mathcal{B} = \{b_i \ (i=1, 2, Card(\mathcal{B}))\}$

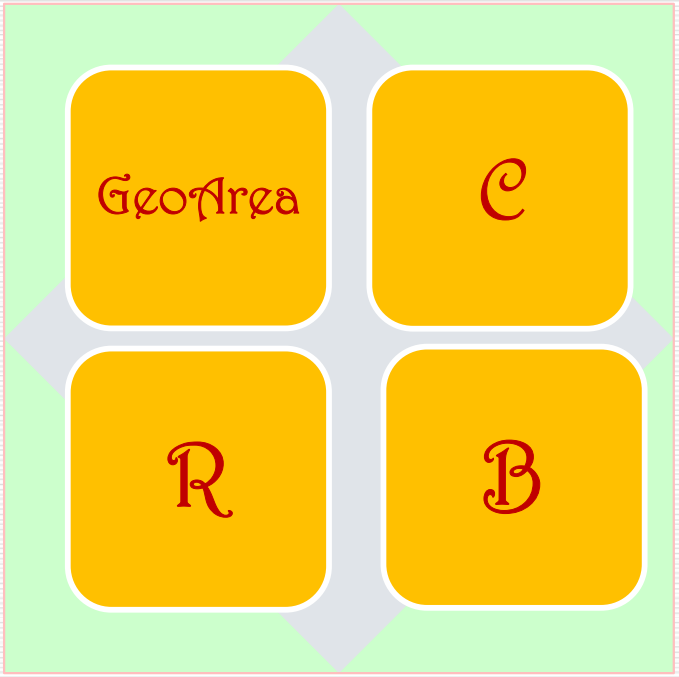
<ID, geom, elevation, exp_i>

A scene depicting previous definitions

PROBLEM FORMULATION

INPUT

OUTPUT



b_i	exp_i

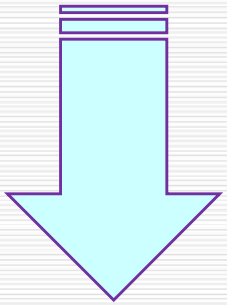
The Ranking

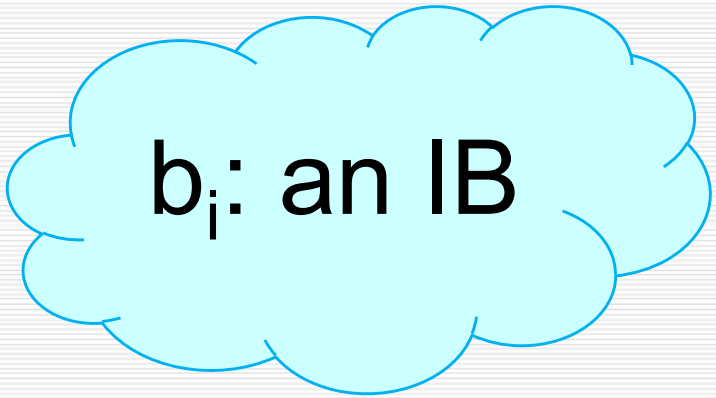
NEXT:

- **how** to detect IBs inside the GeoArea
- **3** metrics

Census of IBs

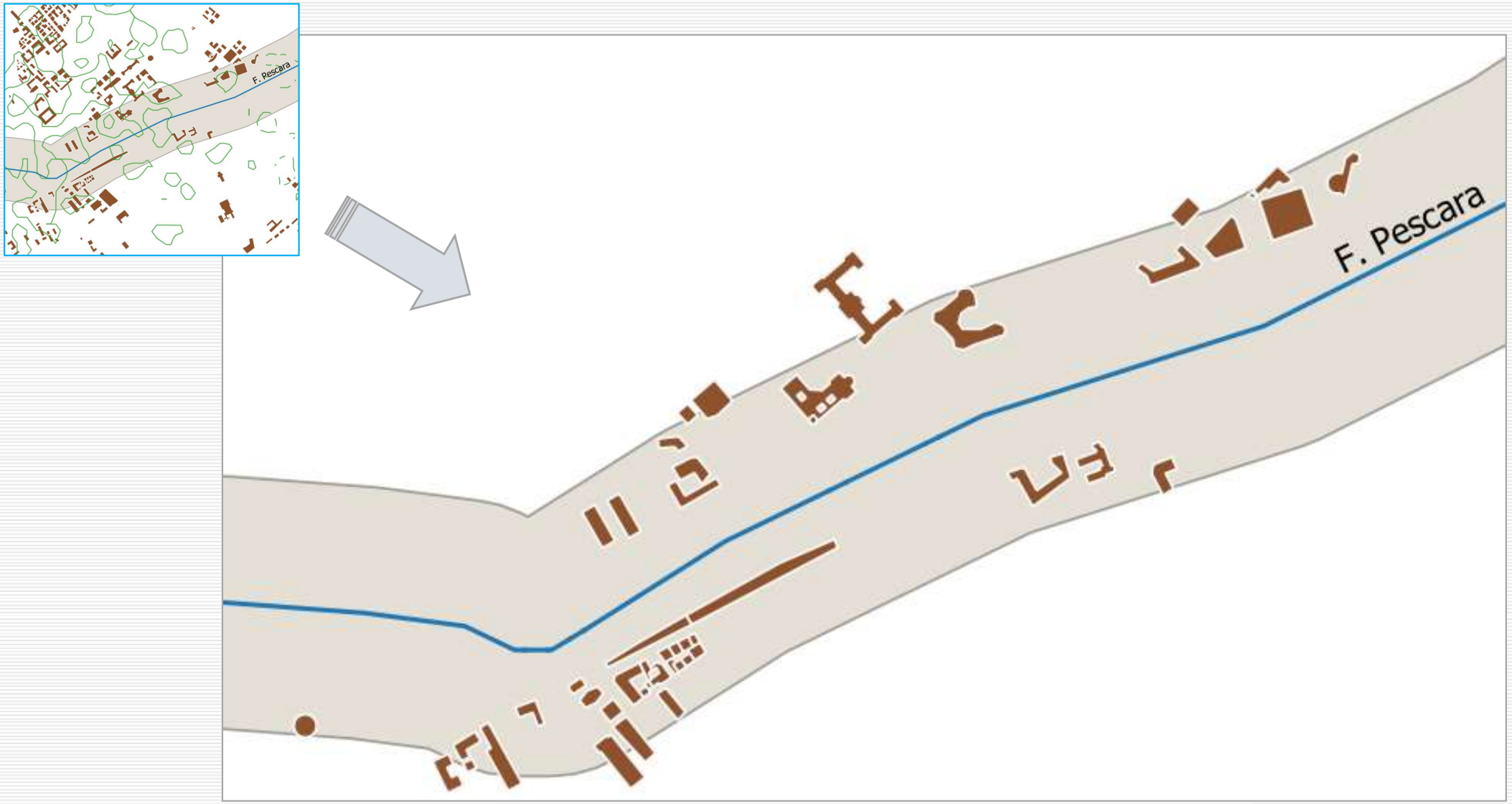
INTERSECTION((geom(b_i), RiverBuffer(r_k)) = **`true`**





Census of IBs (1)

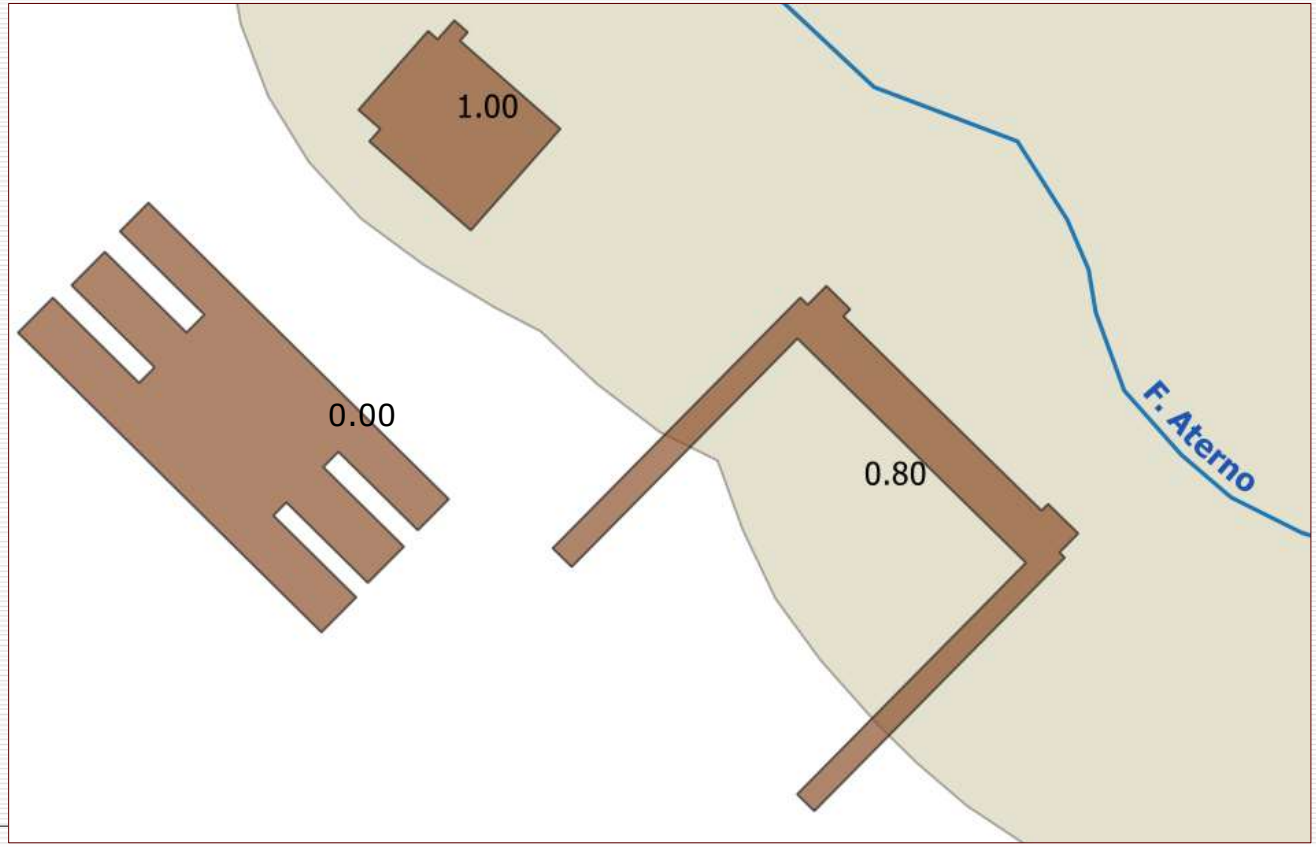
A scene showing few IBs



Parameter P

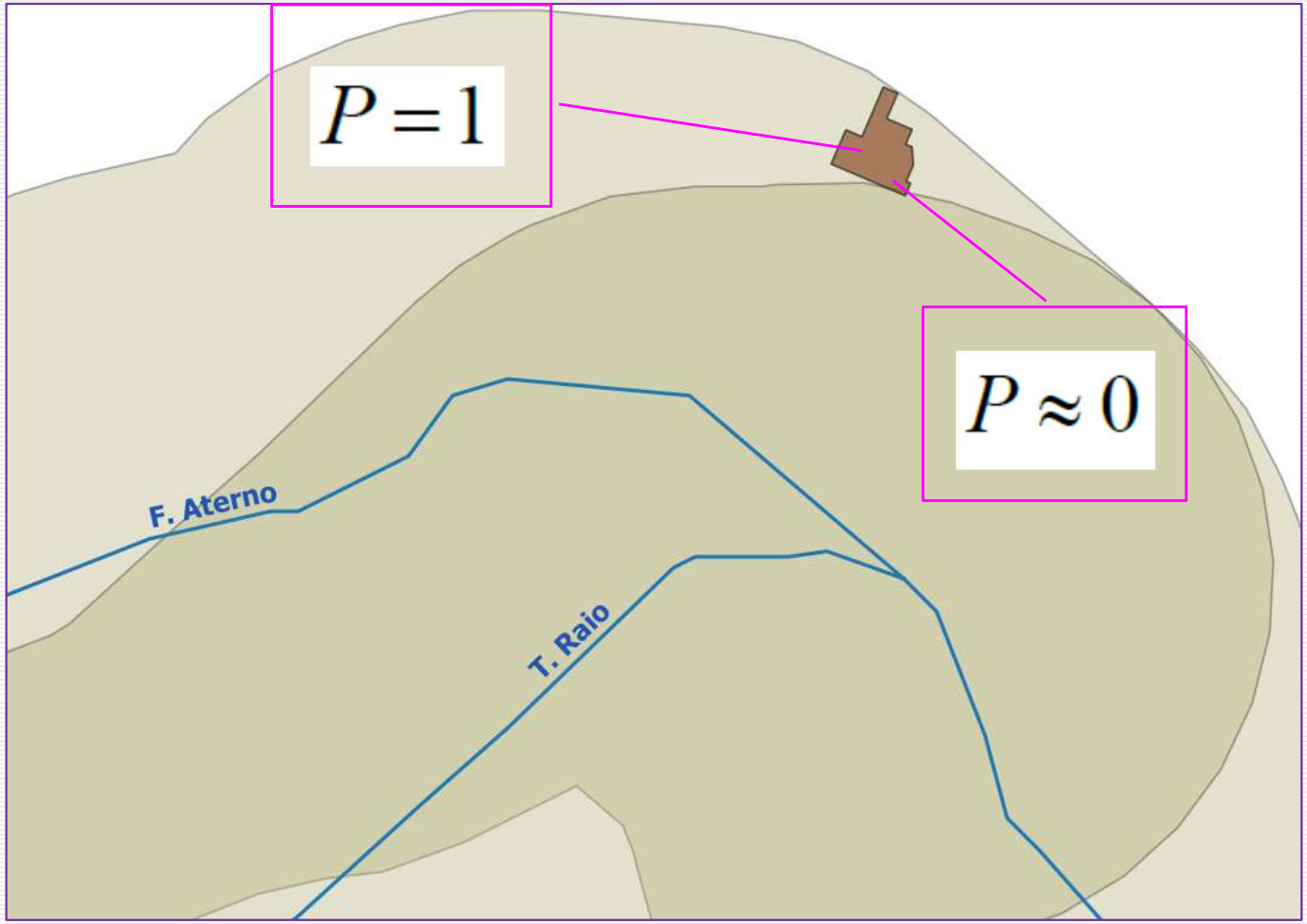
$$P = \frac{Area(geom(b_i) \cap RiverBuffer(r_k))}{Area(geom(b_i))}$$

P in (0,1]

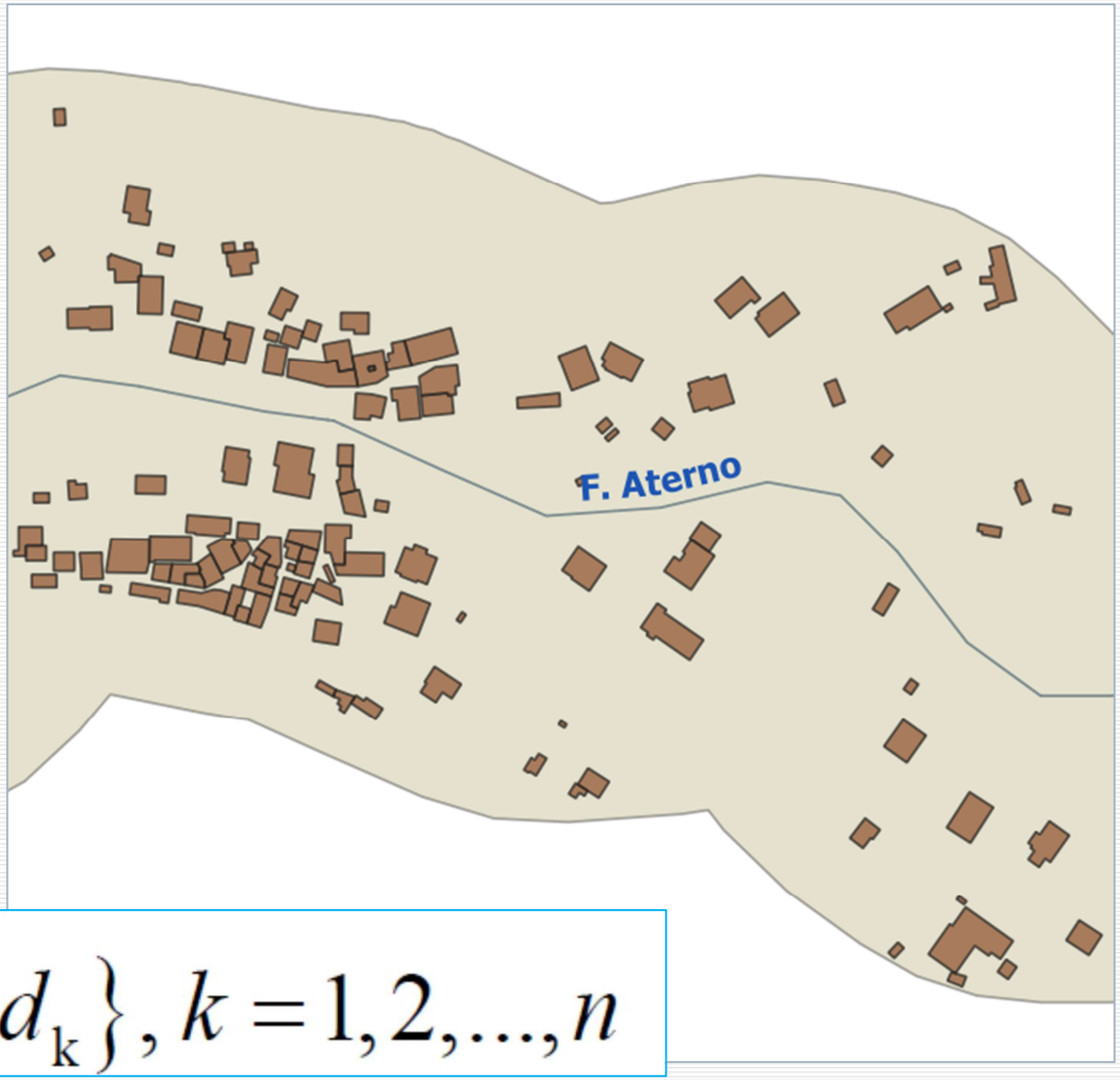


Metric S1

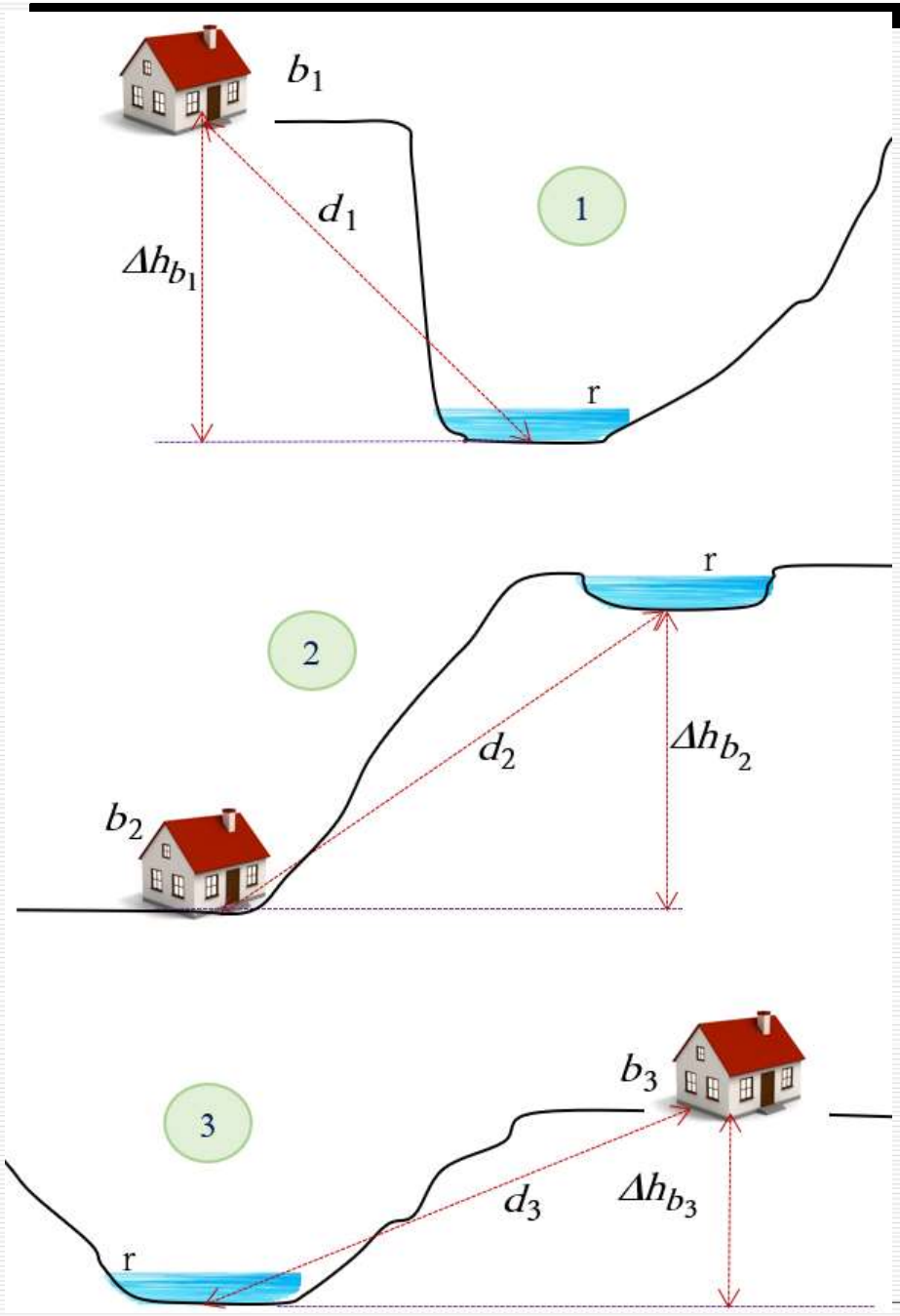
$$S_1 = \max\{P_k\}, k = 1,2,\ldots,n$$



Metric S2



$$S_2 = \max\left\{P_k / d_k\right\}, k = 1,2,\ldots,n$$



THE RANKING:

$$d_1 \approx d_2 \approx d_3$$

b_2: $\Delta h_{b_2} < 0; \Delta h_{b_1} > 0; \Delta h_{b_3} > 0$

b_3: $\Delta h_{b_1} \ll \Delta h_{b_3}$

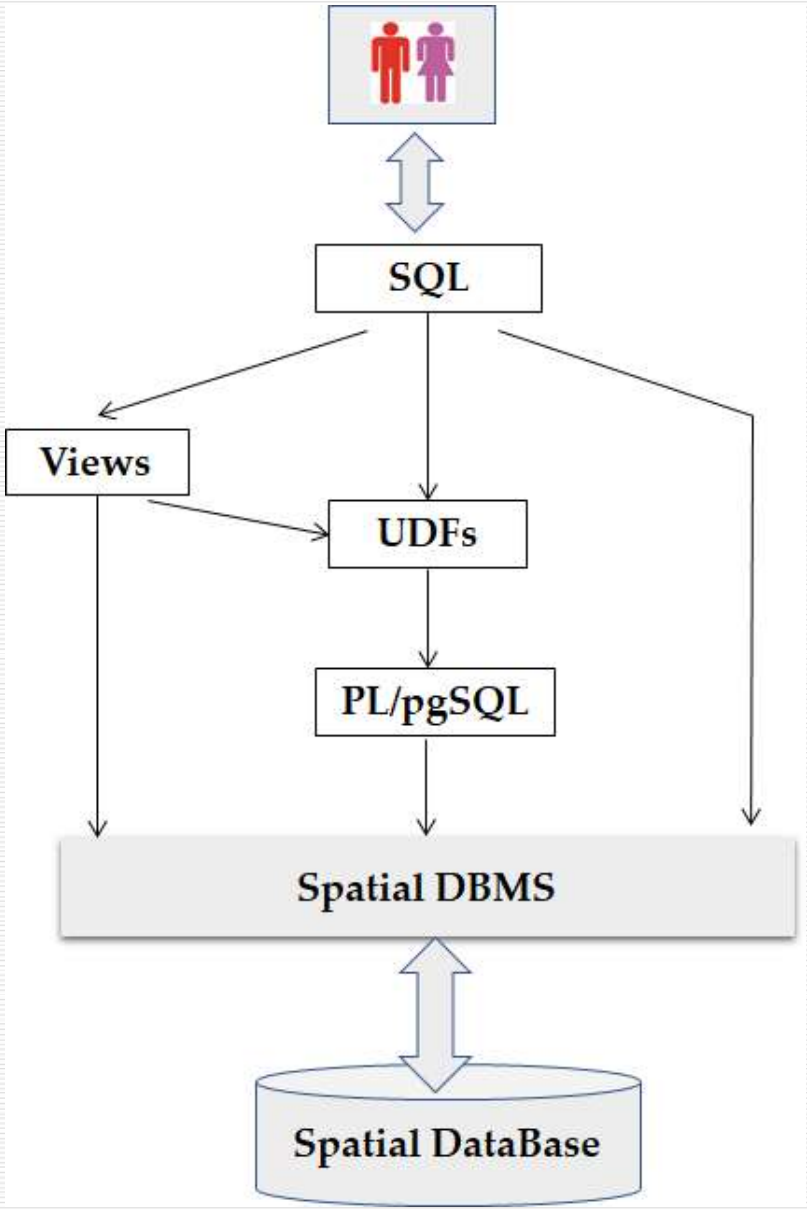
b_1

Metric S3

$$S_3 = max\left\{\frac{P_k \times H_k}{d_k}\right\},\ k \in [1, 2, ..., n]$$

$$H_k = \begin{cases} |\Delta h_{b_i}|\ , \text{ if } \Delta h_{b_i} < 0 \\ 1/\Delta h_{b_i}\ , \text{ if } \Delta h_{b_i} > 0. \end{cases}$$

IMPLEMENTATION



Input Data Sets	Tables
GeoArea	GeoArea
C	ContourLines
R	Rivers
B	Buildings

GeoArea(id, geom);

ContourLines(id, elevation, geom);

Rivers(id, name, geom);

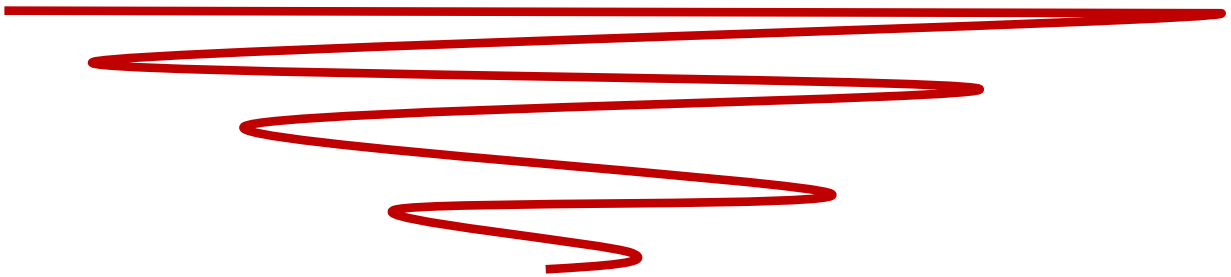
Buildings(id, name, geom, S3);

LAW S 580-B (March, 2018)

Criteria for the execution of procedures for the demolition of IBs

Criteria
Date Crime
Realization Phase
Dangerousness for public/private Safety
Destination Usage
Environmental issues: ➢ **Environmental Impact** ➢ **Environmental Constraints** ← **S3**

THANK YOU



ADDENDUM

The speech is based on a paper you may find here:

ISPRS Int. J. Geo-Information 2019, 8, 510; doi:10.3390/ijgi8110510

Forte, Granata & Nesticò have already studied the problem of setting an order of demolition of IBs.

A Prioritisation Model Aiding

for the Solution of Illegal Buildings Problem, ICCSA 2016

They were inspired by a preliminary version of Law S 580-B (March, 2018)

They proposed the application of the TOPSIS method.

Law S 580-B: ranking is seen as a multicriteria decision problem

TOPSIS

Technique for Order Preference by Similarity to Ideal Solution

Hwang, C.L. and Yoon, K. (1981):

Multiple Attribute Decision Making, Methods & Applications. A State-of-the-Art Survey.

New York: Springer-Verlag.

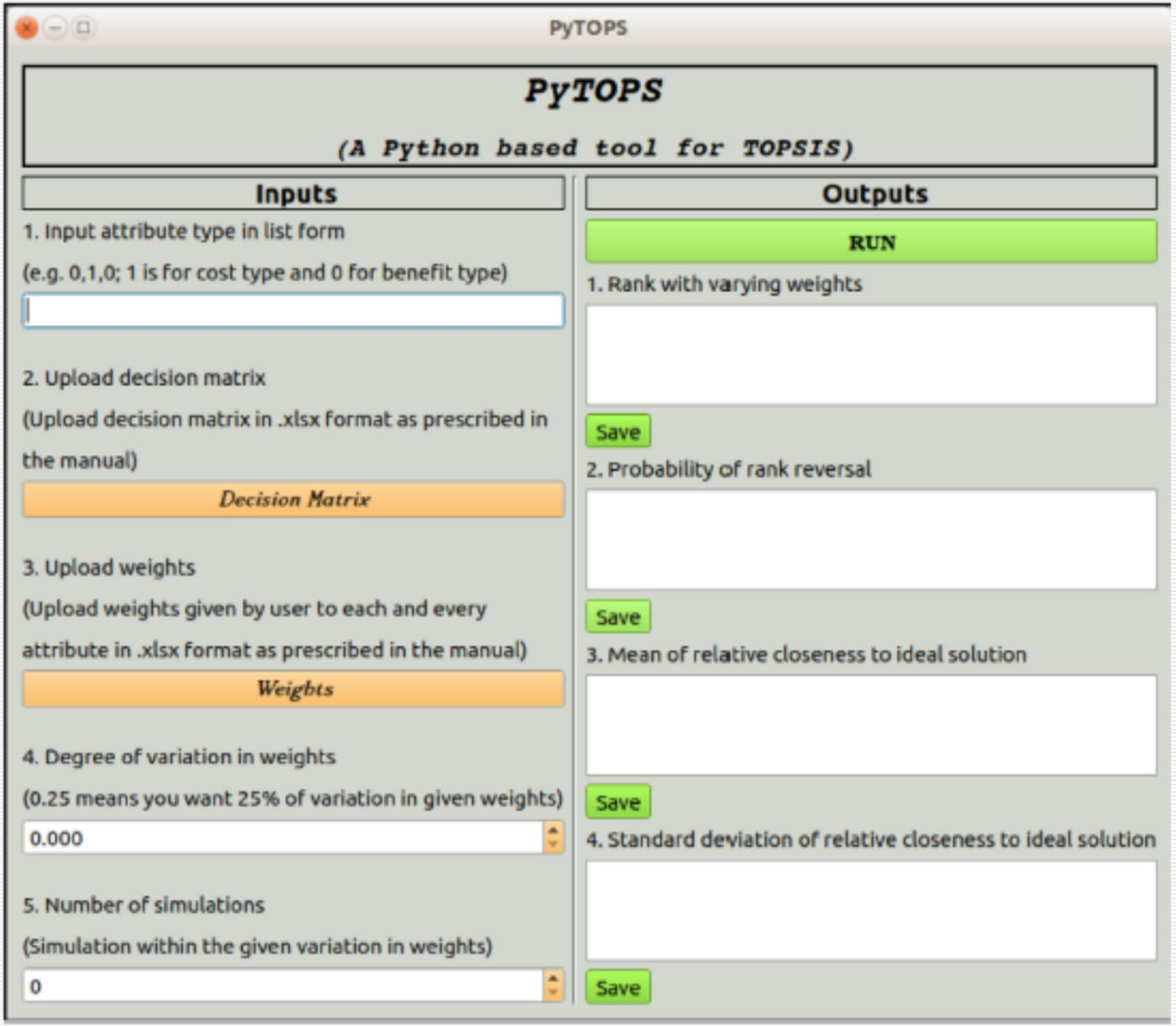
PyTOPS implements TOPSIS

Yadav et al. (2019):

PyTOPS: A Python based tool for TOPSIS.

SoftwareX, 9, 217--222 (2019)

PyTOPS's interface



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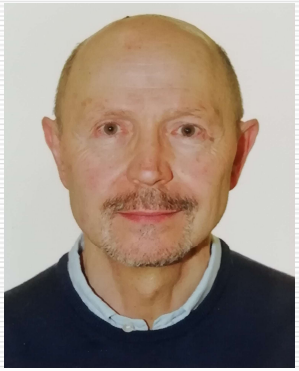
Special Issue:

Submission Deadline: **10 February 2022**

Guest Editor

Prof. Dr. Paolino Di Felice
University of L'Aquila,
67100 L'Aquila, Italy

Interests: software engineering; model-driven engineering; automatic code generation; quality metrics; metadata repository; reuse of UML artifacts



Application to the Applied Sciences Domain of the Model-Driven Engineering

Topics included:

- software engineering
- UML
- MDE
- metrics for UML models
- software tools
- case studies
- empirical data
- measurements