A case study: the Fall Risk Ontology

Prof. Ing. Federico Chesani

DISI

Department of Informatics – Science and Engineering

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Motivation and goal of this lesson

- Understanding Knowledge-based techniques studied so far. How?

- A case study on a real problem…
- … solved using a number of different techniques based on knowledge representation

Reading

- Deandrea S, Lucenteforte E, Bravi F, Foschi R, La Vecchia C, Negri E. **Risk factors for falls in community-dwelling older people: a systematic review and meta-analysis.** Epidemiology. 2010 Sep;21(5):658-68. doi: 10.1097/EDE.0b013e3181e89905. PMID: 20585256.

  https://pubmed.ncbi.nlm.nih.gov/20585256/

Domain description

Domain description

- "Accidents are the fifth-leading cause of death in adults aged 65 years or older (after cardiovascular diseases, cancer, stroke, and respiratory causes)."

- "Falls account for two-thirds of these accidental deaths. Falls are very common, with about 30% of community-dwelling older adults falling every year in developed countries."

- "Falls have a strong impact on health and quality of life of older people."

Domain description

- *"In recent decades, several epidemiologic studies have investigated risk factors for falls."*

- *"…risk factors for falls are generally categorized as intrinsic and extrinsic.*
  - *Intrinsic factors are individual-specific and include **advanced age**, **chronic disease**, **muscle weakness**, **gait** and **balance disorders**, and **cognitive impairment**.*
  - *Extrinsic factors generally include **medication use**, **environmental hazards**, and **hazardous activities**."*

Goal of this case study

Develop a prediction tool that:

- Given in input the exposure of a subject versus risk factors…

- … compute the risk.

HOW?

Proposed methodology

Premise

From the Deandrea paper we know:

- which are the Risk Factors (Table 3,4,5, and 6)
- which are the odds ratio (Table 3,4,5, and 6)

- for each risk factor, we know also the literature sources (Deandrea's paper is a meta-analysis: data come from other studies and reviews)

Method

Let us **SEPARATE** the knowledge provided by Deandrea **FROM** the algorithm/tool we will use to make predictions; a complete separation between:

- what we (physicians) know

- how we model the risk

Components:

1. A computer-interpretable representation of what we (the physicians) knows

2. A tool that generates a prediction model

3. The prediction model

4. Some nice GUI

1. The representation of what we know

Desiderata:

- should be inspectable by non-engineers
- should be sharable
- should be formal

Moreover, medical research makes progress every day, hence:

- it should be possible to add new knowledge (new risk factors)
- it should be possible to update info about each risk factor
- it should keep track of the medical literature supporting risk factors and odds ratios

Things we know – Risk factors

From the paper, there is a list of risk factors. Each of them:

- Might be behavioural (e.g. climbing ladders), endogenous, environmental

- Might be irreversible (e.g. Parkinson) or reversible (e.g. vision impairment due to cataract)

- Might be compensable or not

- Might be direct or indirect

- **Each risk factor contributes to the risk of falling in a manner proportional to the odds ratio.**

Things we know – Risk factors

From the paper, there is a list of risk factors. Each subject is exposed to a risk factor:

- in a yes/no/don't know manner

- with a certain degree, from 0 up to MAX_R_i

- statistically, for each risk factor there is a population prevalence

Problem: how to determine if a subject is exposed to a risk factor?

E.g.: vision impairment is a risk factor; how vision impairment is determined?

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Things we know – Risk factors and estimators

For each risk factor there exists an estimator of the exposure of the subject to the risk factor:

- in a yes/no/don't know manner

- with a certain degree, from 0 up to MAX_R_i

- with a function that, given the estimators, returns the exposure level towards that risk factor

- There might be more than one estimators for each risk factors

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

federico.chesani@unibo.it