



ALMA MATER STUDIORUM
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A case study: the Fall Risk Ontology

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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
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- **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?



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





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