UNIVERSIDAD DE ALMERÍA

Research Topics

DKSE (TIC-181)

Data, Knowledge and Software Engineering

FQM-244

Grupo de análisis de datos

Outline

1. Requirement engineering
2. Bayesian networks and RE
3. Next release problem
4. Clustering and Requirements prioritization

Main topics TIC-181

- **Integration between Software Engineering (Req. Engineering) and Knowledge Engineering.**
- **Search based Software engineering**
- **Information Systems based on Internet for agricultural production.**
- Knowledge Based Systems. Acquisition, Modeling and Knowledge Management
- Temporal reasoning
- Temporal data mining

1. Requirements Engineering

Requirements engineering

Requirement engineering involves activities for information systems development related to the management and definition of needs, restrictions and the quality features for both new and current systems.

Current situation

- Despite of the progress in IT (Information Technology), in most of the projects
  - expected results are not reached
  - releases are delayed in time
  - initial budgets are exceeded
  - final software is released with too many errors.

AI – SE Synergistic Collaboration

- Requirements stage is considered a good application domain for AI techniques because of the requirements nature.
- Software requirements express and establish the needs and constraints that contribute to the solution of a real world problem.
- However, requirements tend to be imprecise, incomplete and ambiguous.

Artificial intelligence techniques

2. Bayesian networks and RE

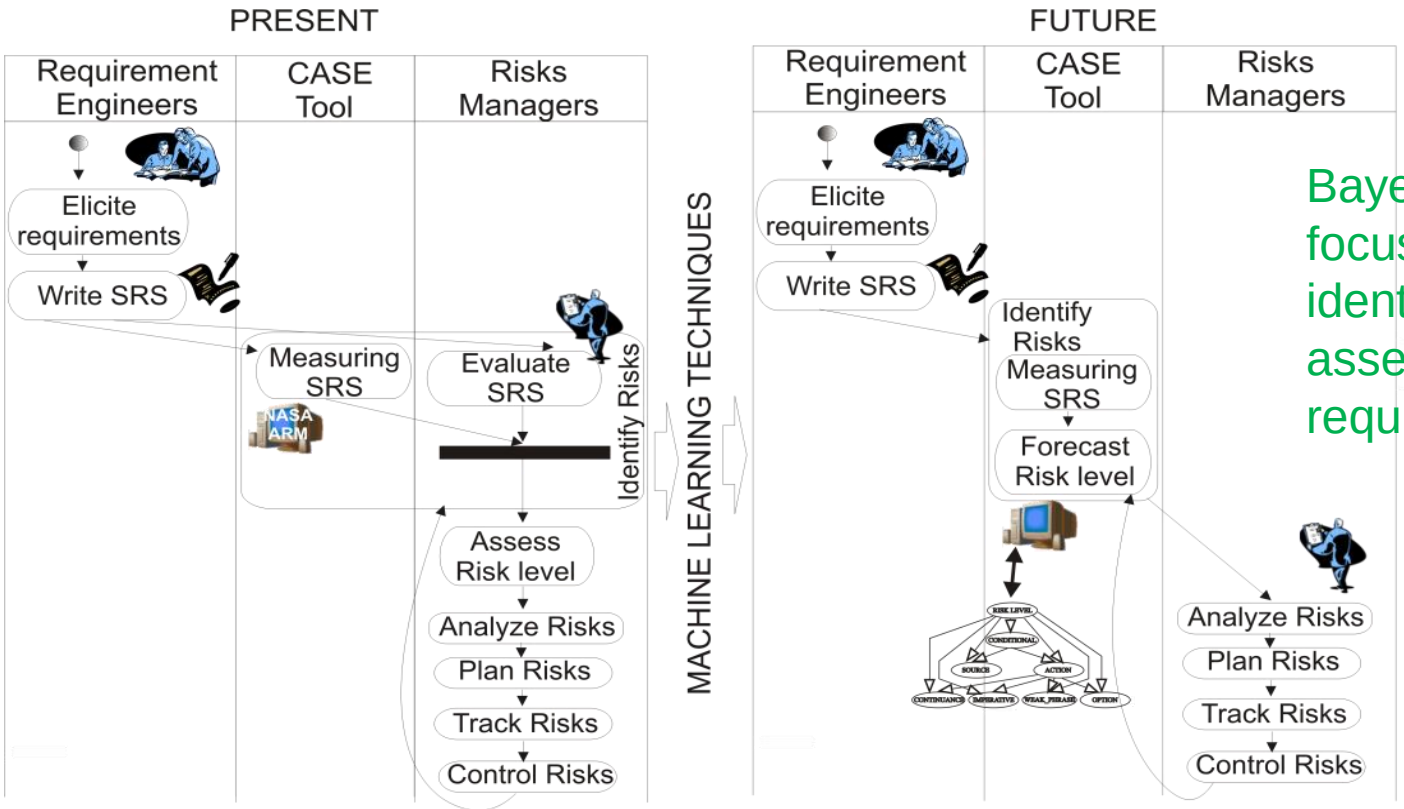
- **Bayesian Networks** are a well-known Artificial Intelligence technique suitable in handling decision-making problems involving uncertainty
- They have been successfully applied in prediction.

del Sagrado, José, and Isabel M. del Aguila. "**Stability prediction of the software requirements specification**." *Software Quality Journal* 26.2 (2018): 585-605.

del Águila, Isabel M., and José del Sagrado. "**Development of Knowledge-Based Systems Which Use Bayesian Networks**." *Synergies Between Knowledge Engineering and Software Engineering*. Springer, Cham, 2018. 55-73.

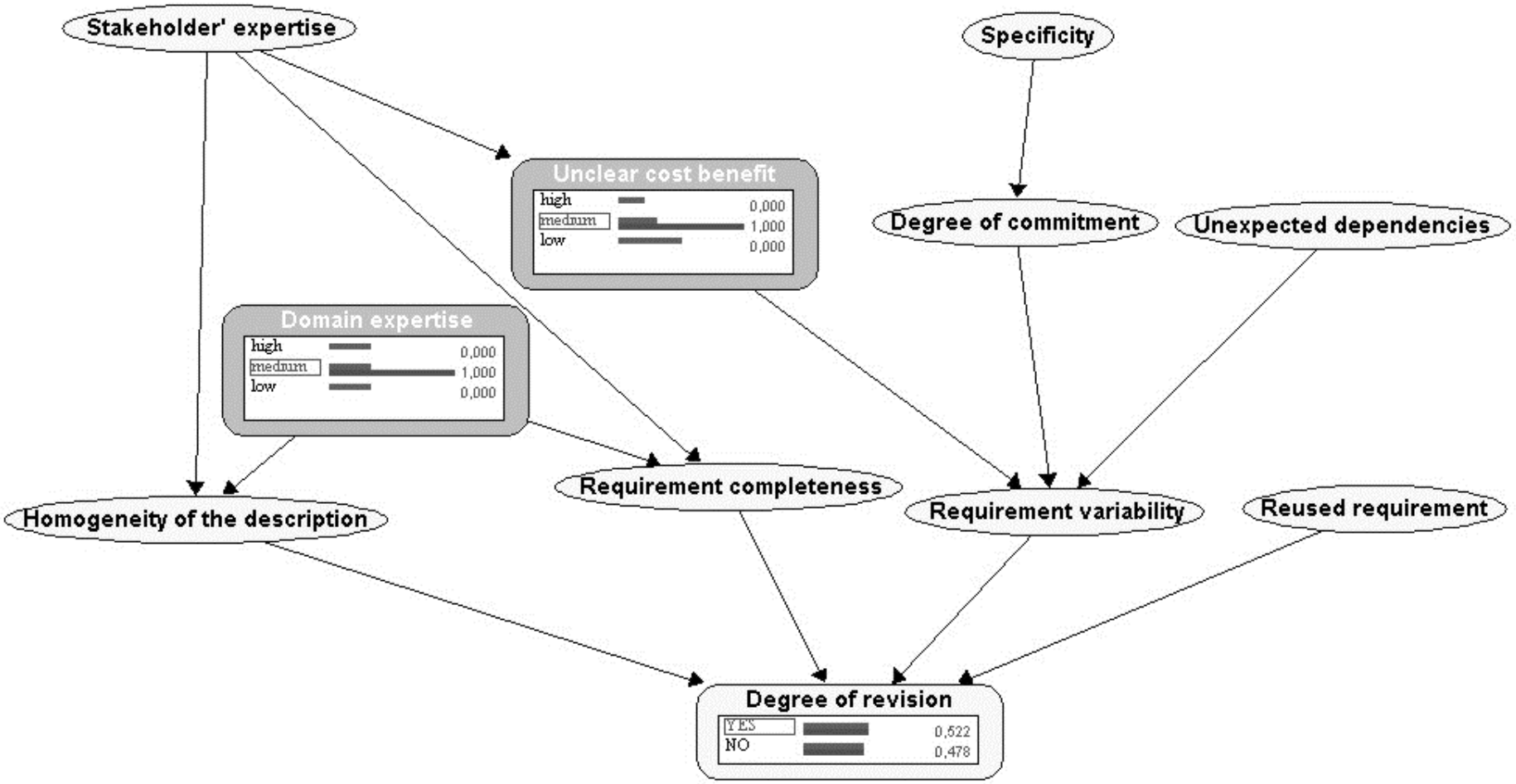
del Águila, Isabel M. and del Sagrado, José. **Requirement risk level forecast using Bayesian networks classifiers**. International Journal of Software Engineering and Knowledge Engineering, 21 (2), pp. 167-190, 2011.

REQUIREMENT RISK LEVEL FORECAST USING BAYESIAN NETWORKS CLASSIFIERS



Bayesian networks focusing on the identification and assessment of risky requirements.

Stability prediction of the software requirements specification



Development of Knowledge-Based Systems Which Use Bayesian Networks

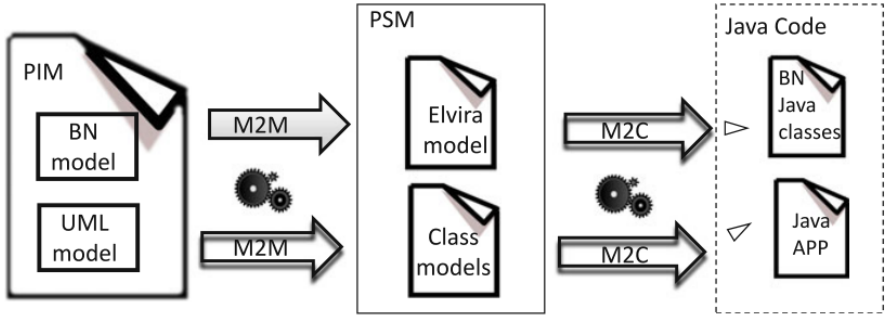
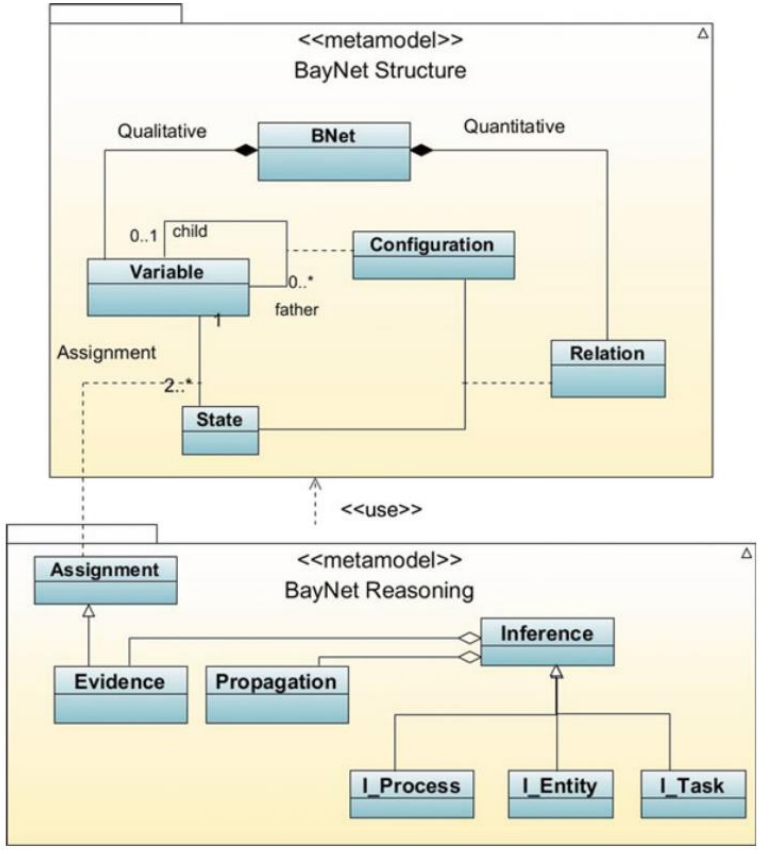


Fig. 4 MDA for BN-based KBS



3. Next release problem

Results

del Sagrado, José, Isabel M. del Águila, and Francisco J. Orellana. **Multi-objective ant colony optimization for requirements selection**. Empirical Software Engineering (2013).

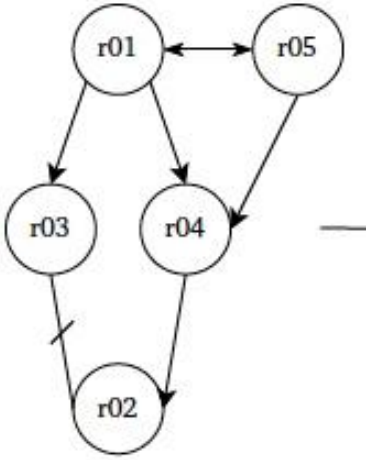
del Sagrado, José; Águila, Isabel María; Orellana, F.J. **Metaheuristic aided software features assembly**, 20th European Conference on Artificial Intelligence, ECCAI 2012, August 27-31, 2012, Montpellier, France, pp. 1009-1010.

del Águila, Isabel M., and José del Sagrado. "**Three steps multiobjective decision process for software release planning**." Complexity 21.S1 (2016): 250-262.

Domínguez-Ríos, Miguel Ángel, et al. **"Efficient anytime algorithms to solve the bi-objective Next Release Problem.**" *Journal of Systems and Software* 156 (2019): 217-231

Sierra Ibáñez, José Antonio. ***Algoritmo de estimación de distribución para la selección de requisitos software***. Trabajo Fin de Máster. Máster en tecnologías y aplicaciones en Ingeniería Informática, 2019.

EDAs y selección de requisitos



Algoritmo 1 Código general EDA

1: $D_0 \leftarrow$ Se generan N individuos ▷ Población inicial
2: **repetir para** $l = 1, 2, \ldots$
3: $D_{l-1}^{Se} \leftarrow$ Se seleccionan $Se \leq N$ individuos de D_{l-1} por medio de una función objetivo
4: $p_l(x) = p(x \mid D_{l-1}^{Se}) \leftarrow$ Distribución de probabilidad estimada para la población l-ésima
5: $D_l \leftarrow$ Se muestrea la nueva población a partir de $p_l(x)$
6: **hasta** Condición de parada

1. EDAs como *técnica de exploración* en la selección de requisitos.
2. Uso de las *dependencias funcionales* como guía en el proceso de exploración:
   a. Determinar una estructura adecuada para el EDA.
   b. Investigar el impacto de distintas distribuciones de probabilidad en la selección de requisitos.

4. Clustering and Requirements prioritization

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Full Title:	Assisted requirements selection by clustering
Article Type:	Original Research
Keywords:	requirements selection; next release planning; requirements prioritization; MoSCoW; cluster analysis
Corresponding Author:	Isabel María del Aguila, Ph.D. University of Almería Almería, SPAIN
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Corresponding Author's Institution:	University of Almería

del Sagrado, José, Isabel María del Águila, and Alfonso Bosch. **Expansión cuantitativa del método MoSCoW para la priorización de requisitos**. JISBD 2018.

	Category	Meaning
M	Must have	High satisfaction - Low effort
S	Should have	High satisfaction - High effort
C	Could have	Low satisfaction - Low effort
W	Won't have	Low satisfaction - High effort

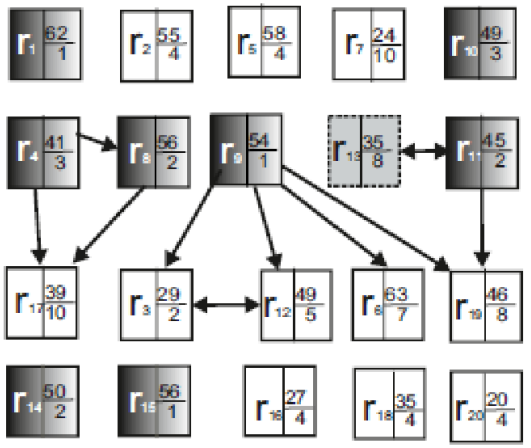
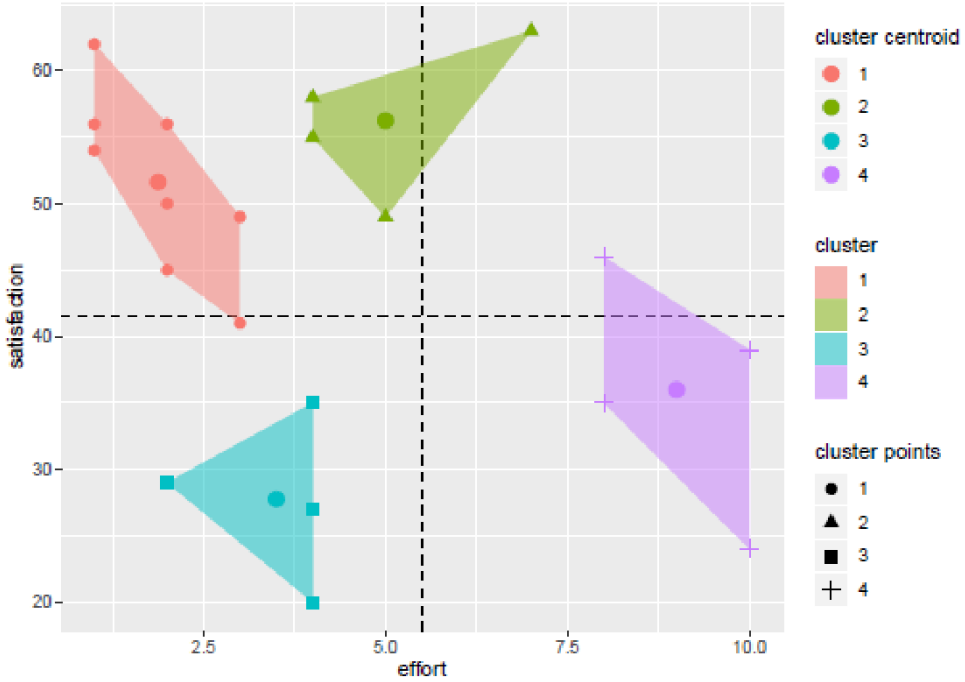


Fig. 4 The viable product based on MoSCoW categories ($k = 4$)



Any ideas for collaboration?