Probabilistic Decision Support Systems
Results & Trends

Antal Péter

ComBine Lab

Artificial Intelligence group

Department of Measurement and Information Systems

Agenda

- Results
- Trends
- AI Group@BME
- Consultation

Results: figs

Results: numbers

Neptun	kisHFpont	nagyHF	"ZH"	átlag	jegy
A72CSN	4.5			1.35	
AER5T5	4.5			1.35	
AUKIM7	4.75			1.425	
AW3SLJ	0			0	
C0F7JT	5	3		2.4	
CCA2VH	4.75	2	4	3.625	4
CX9K0A	0			0	
D3GAU7	4	3	3	3.3	3
DP7RWY	5	5	5	5	5
F262M8	4.75	4	4	4.225	4
FGE8ZM	1.25			0.375	
FXMVSW	4			1.2	
GZWA7Z	3	5	5	4.4	4
H4O0I6	5.5	2	4	3.85	4
I0UA10	1			0.3	
IKX1SH	4.5	5		2.85	
IO2688	5			1.5	
JG0SS6	0			0	
JKDD04	5			1.5	
JQKC0Y	5		5	3.5	
JRMP4U	3.25	4	3	3.375	3
KIQHL3	5.5	5	5	5.15	5
KTNKN5	5.25		4	3.175	
MJLEBR	0			0	
MSY8L7	4.75			1.425	
NPRSDP	4	4	3	3.6	4
OXO676	5.5	5	5	5.15	5
QEFP6O	0			0	
QMPDME	5	5	3	4.2	4
RASEZV	4.25		0	1.275	
SJ4OGQ	3.75	4		2.325	
SLQ311	4.75		5	3.425	
U4Q76R	0			0	
UM38EE	5	4		2.7	
VDS3NB	4.25	1	0	1.575	
VH9WGV	3.25			0.975	
VY4K2V	5.25	5	5	5.075	5
W0FDTI	4.75	5	4	4.525	5
WMAQHJ	0			0	
WZK4KM	5	5	5	5	5
X7BMAN	5.5	4	5	4.85	5
YUIRY8	5	3		2.4	
Z3VT07	0			0	
ZB7UXS	5	5	3	4.2	4

Results: ideas (dreams ;-) and solutions
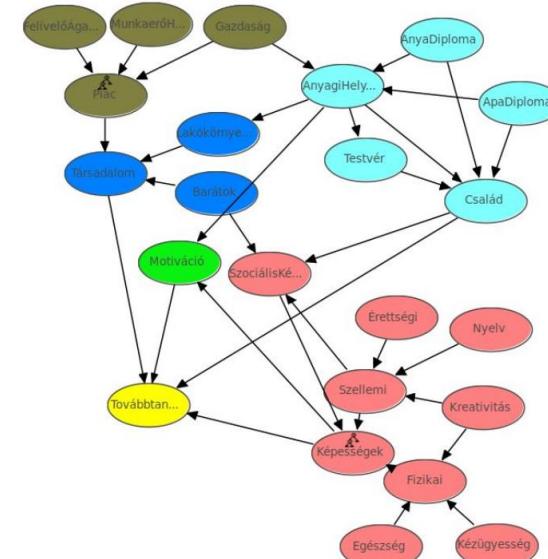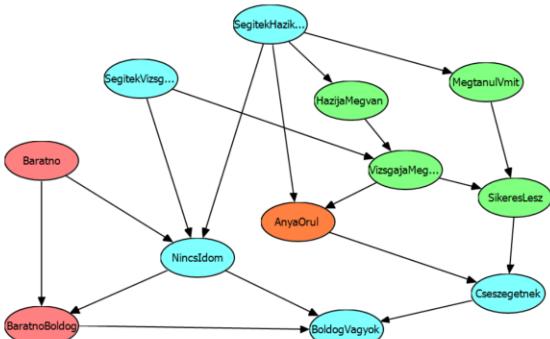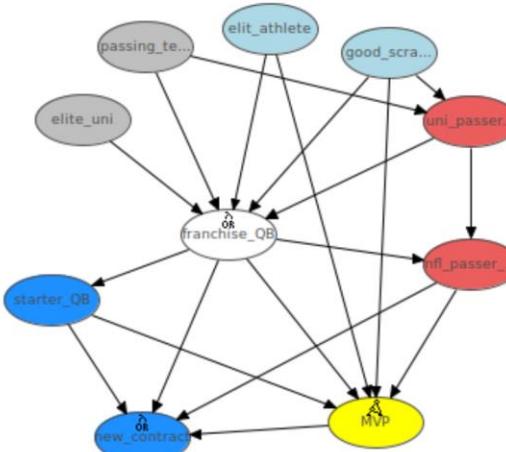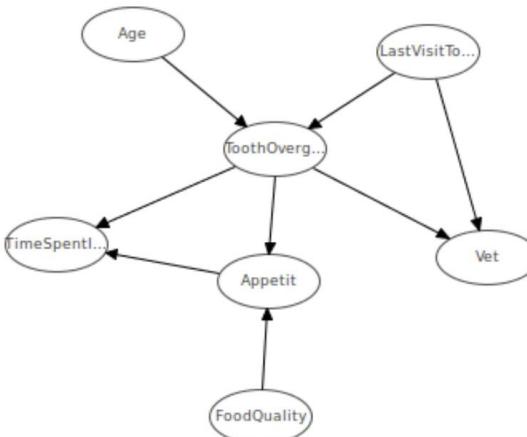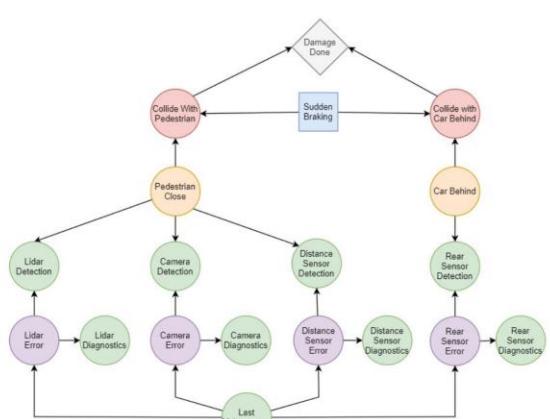
Results: ideas (dreams ;-) cont'd
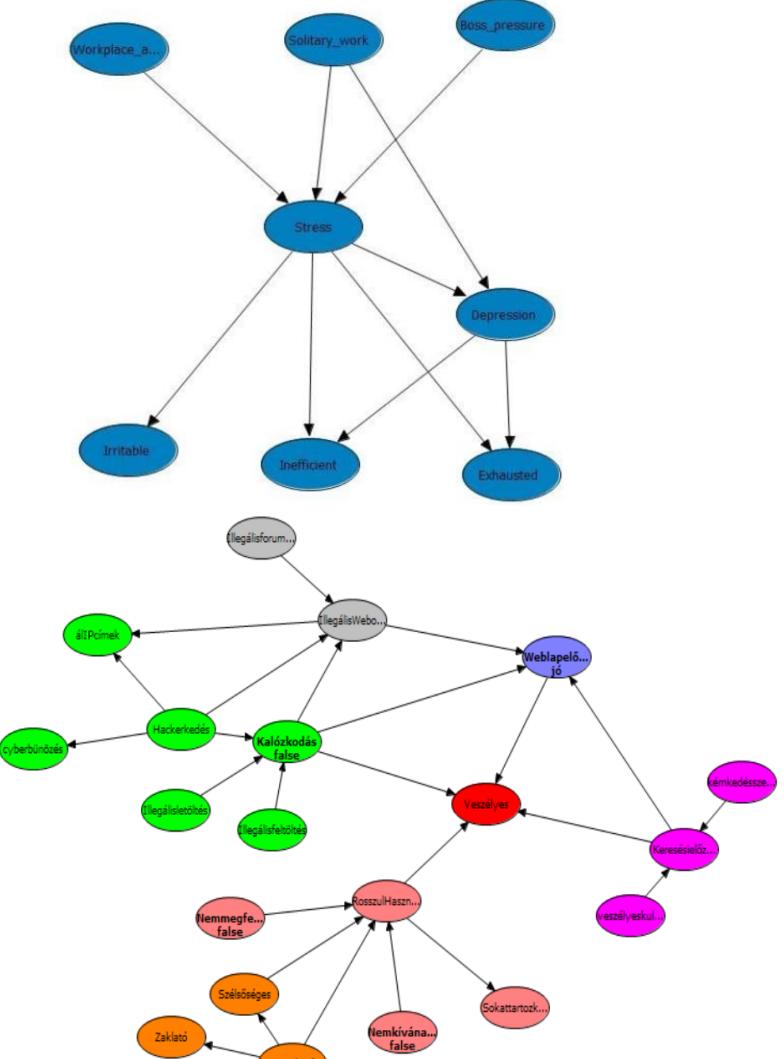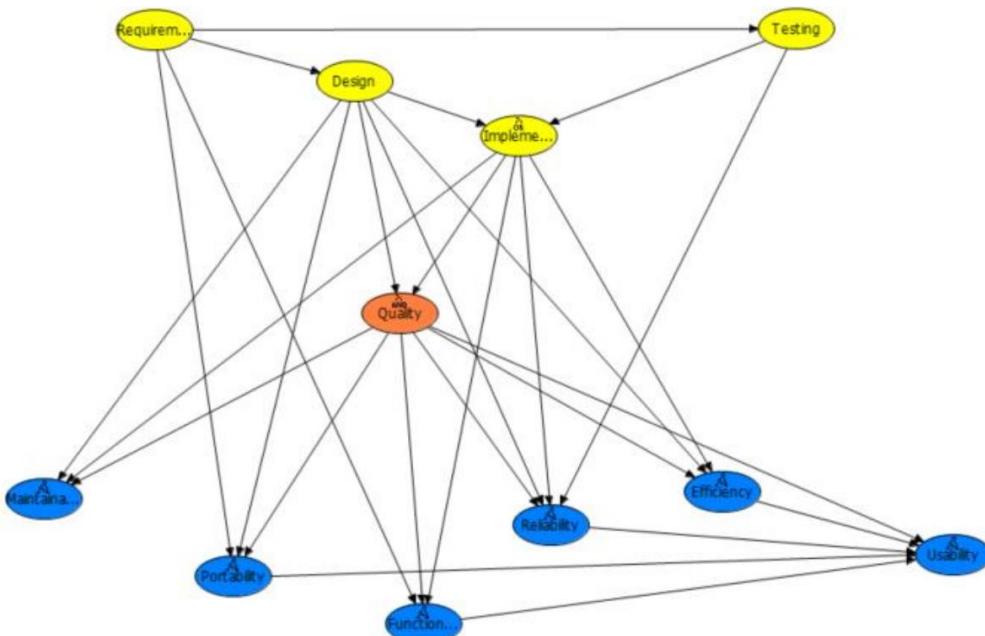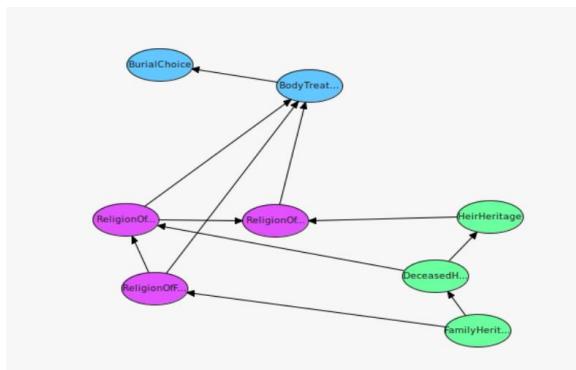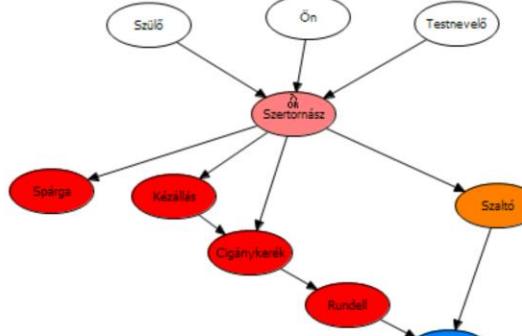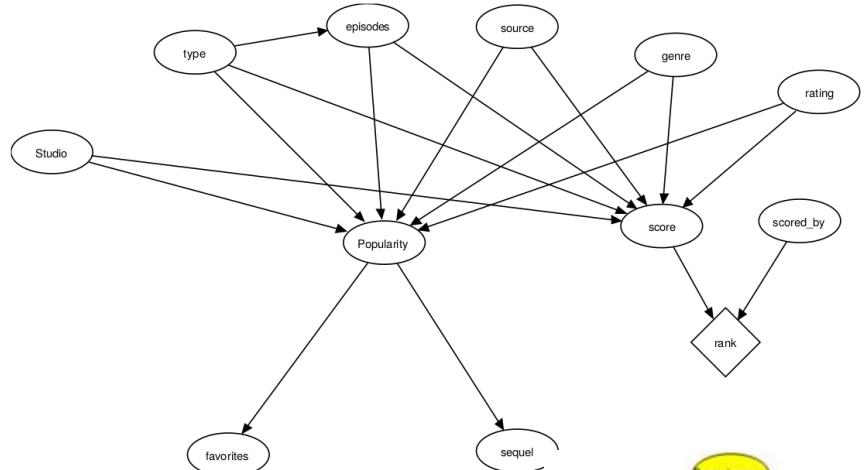
Results: ideas (dreams ;-) cont'd
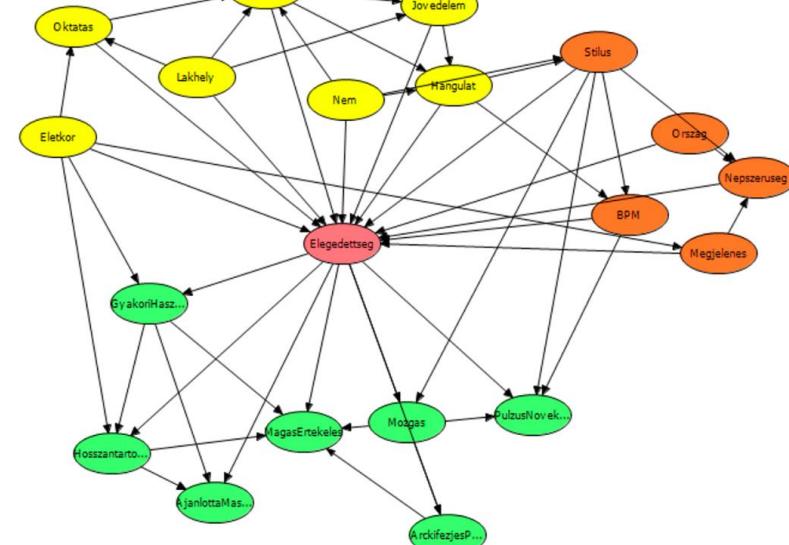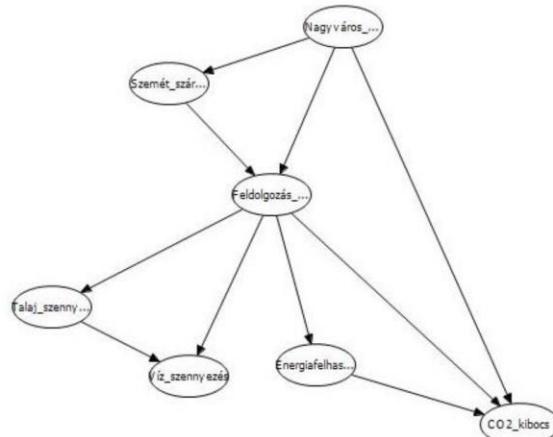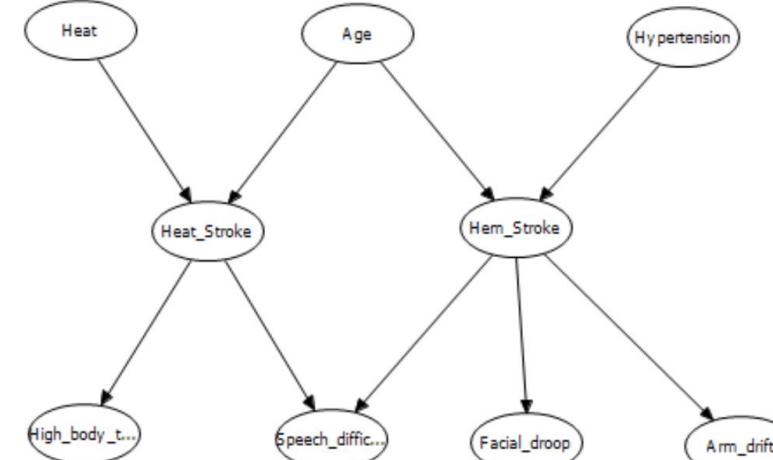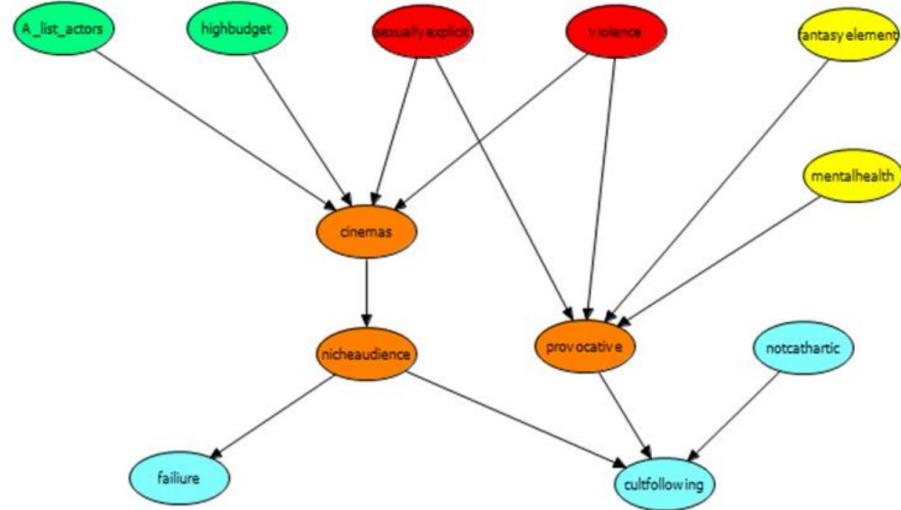
Trends

Artificial Intelligence: A Modern Approach, 4th Edition
Stuart Russell, University of California at Berkeley
Peter Norvig, Google Inc.

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- Judea Pearl (Section 13.5, Causal Networks);
- Vikash Mansinghka (Section 15.3, Programs as Probability Models);
- Michael Wooldridge (Chapter 18, Multiagent Decision Making);
- Ian Goodfellow (Chapter 21, Deep Learning);
- Jacob Devlin and Mei-Wing Chang (Chapter 24, Deep Learning for Natural Language);
- Jitendra Malik and David Forsyth (Chapter 25, Computer Vision);
- Anca Dragan (Chapter 26, Robotics).

https://www.pearson.com/us/higher-education/program/Russell-Artificial-Intelligence-A-Modern-Approach-4th-Edition/PGM1263338.html
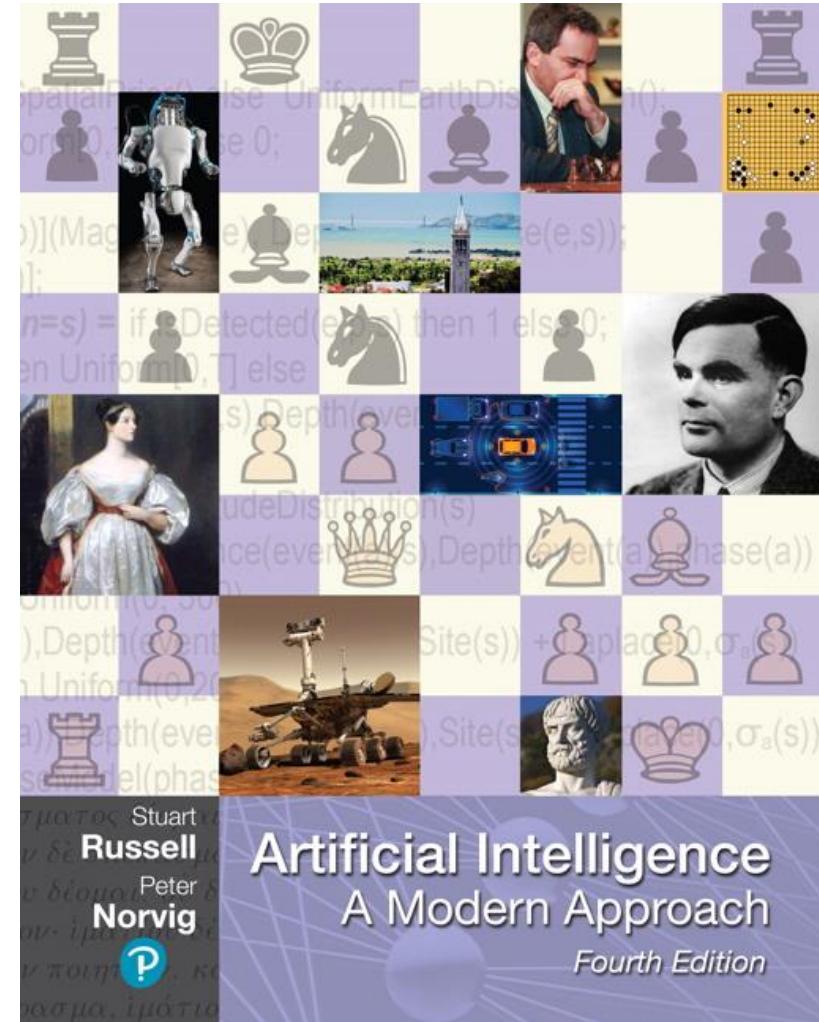
AIMA 4th:

- We focus more on machine learning rather than hand-crafted knowledge engineering, due to the increased availability of data, computing resources, and new algorithms.

- Deep learning, probabilistic programming, and multiagent systems receive expanded coverage, each with their own chapter.

- The coverage of natural language understanding, robotics, and computer vision has been revised to reflect the impact of deep learning.

- The robotics chapter now includes robots that interact with humans and the application of reinforcement learning to robotics.

- Previously we defined the goal of AI as creating systems that try to maximize expected utility, where the specific utility information—the objective—is supplied by the human designers of the system. Now we no longer assume that the objective is fixed and known by the AI system; instead, the system may be uncertain about the true objectives of the humans on whose behalf it operates. It must learn what to maximize and must function appropriately even while uncertain about the objective.

- We increase coverage of the impact of AI on society, including the vital issues of ethics, fairness, trust, and safety.

- We have moved the exercises from the end of each chapter to an online site. This allows us to continuously add to, update, and improve the exercises, to meet the needs of instructors and to reflect advances in the field and in AI-related software tools.

- Overall, about 25% of the material in the book is brand new. The remaining 75% has been largely rewritten to present a more unified picture of the field. 22% of the citations in this edition are to works published after 2010.

Artifical Intelligence Group

Members:
- 1 full professor, 5 associate professors
- + 8 staff members and researchers
- + PhD students

Areas of competence:
- natural language processing
- semantic technologies
- image processing
- statistical data analysis
- machine learning
- multi-agent systems
- large-scale data and knowledge fusion
- law and legal systems
- chemoinformatics (drug discovery)
- bioinformatics (statistical genetics)
- clinical decision support

Mission

AI group: comprehensive approach to artificial intelligence and machine learning

ComBine Lab (bioinfo): advance&translate artificial intelligence and machine learning methods for the life sciences.

Image processing: integration of measurement, image processing, and clinical decision support.

Distributed intelligence: multi-agent systems, collaborative learning, sensor nets, smart cities, wearable electronics

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AI at scale

- Long-term vision: 25< years!

  https://ai25.mit.bme.hu/

- Encyclopediae of AI
  - Russel&Norvig: AI: a modern approach
  - "MI Almanach"

    http://mialmanach.mit.bme.hu/

- Artificial general intelligence
  - http://www.mit.bme.hu/oktatas/targyak/vimiav22

- Computational biomedicine
 - Reward processing dysfunctions of the human mind

Oktatás

- **B.Sc. - alapképzés**
  - Mesterséges intelligencia
- Választható tárgyak
  - Neurális hálózatok
  - Mesterséges általános intelligencia
  - Bioinformatika

- **M.Sc. - Intelligens Rendszerek mellékspecializáció**
  - Valószínűségi döntéstámogató rendszerek
  - Gépi tanulás
  - Kooperáció és gépi tanulás laboratórium
  - Komplex MI alkalmazások

- **M.Sc. - E.ü.mérnök**
  - Biostatisztika

- **Ph.D. képzés**
  - Intelligens adatelemzés

Driver fatigue model
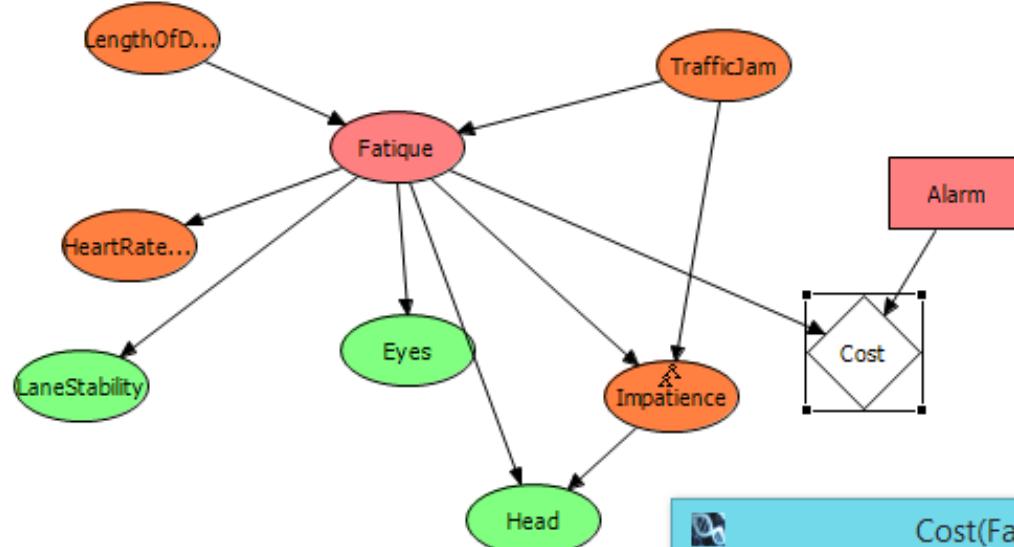
2020. 05. 18.

Bayesian disease map
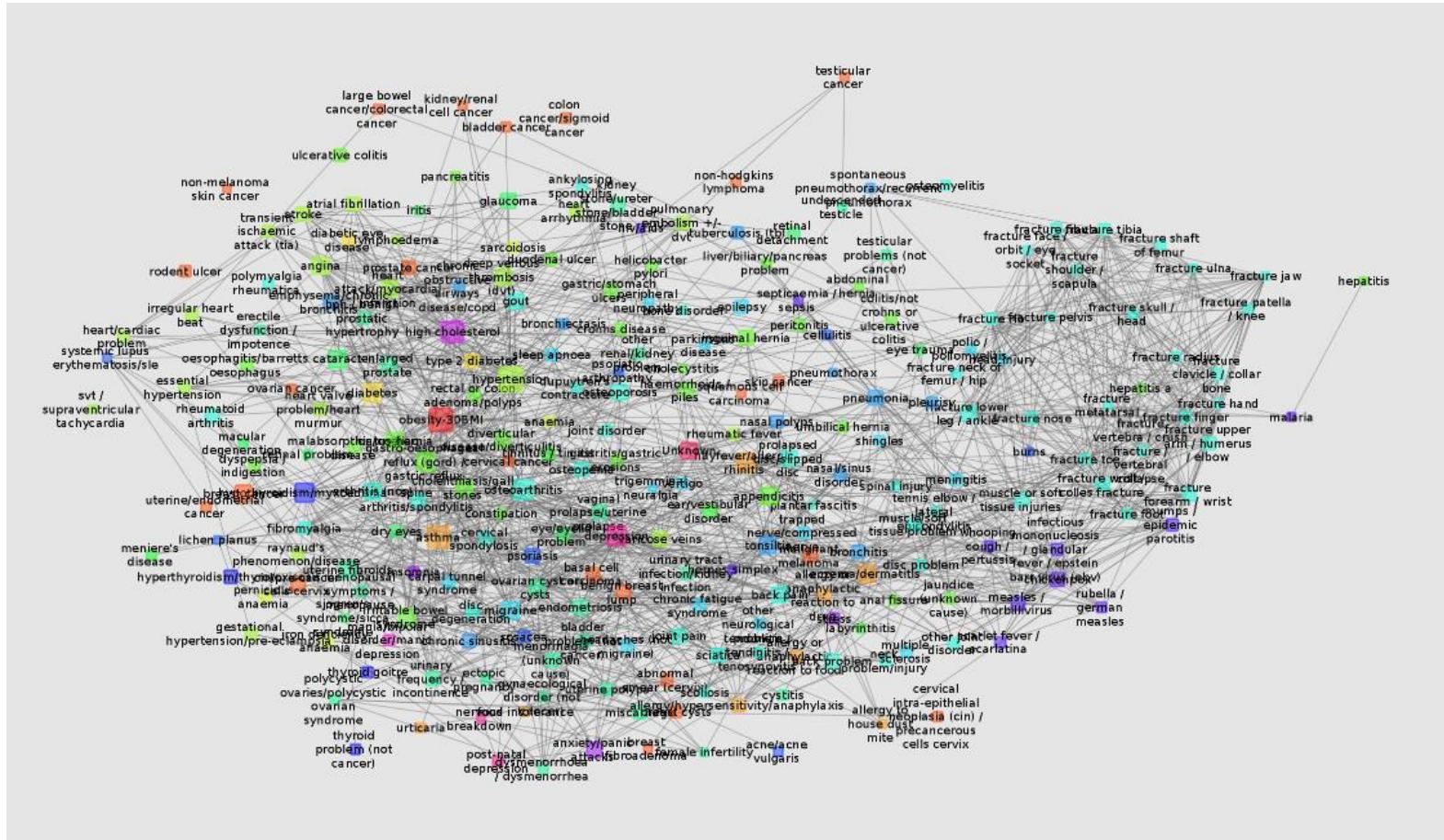
Marx, P., Antal, P., Bolgar, B., Bagdy, G., Deakin, B. and Juhasz, G., 2017. Comorbidities in the diseasome are more apparent than real. *PLoS computational biology*, *13*(6), p.e1005487.

Knowledge-transfer to neural networks
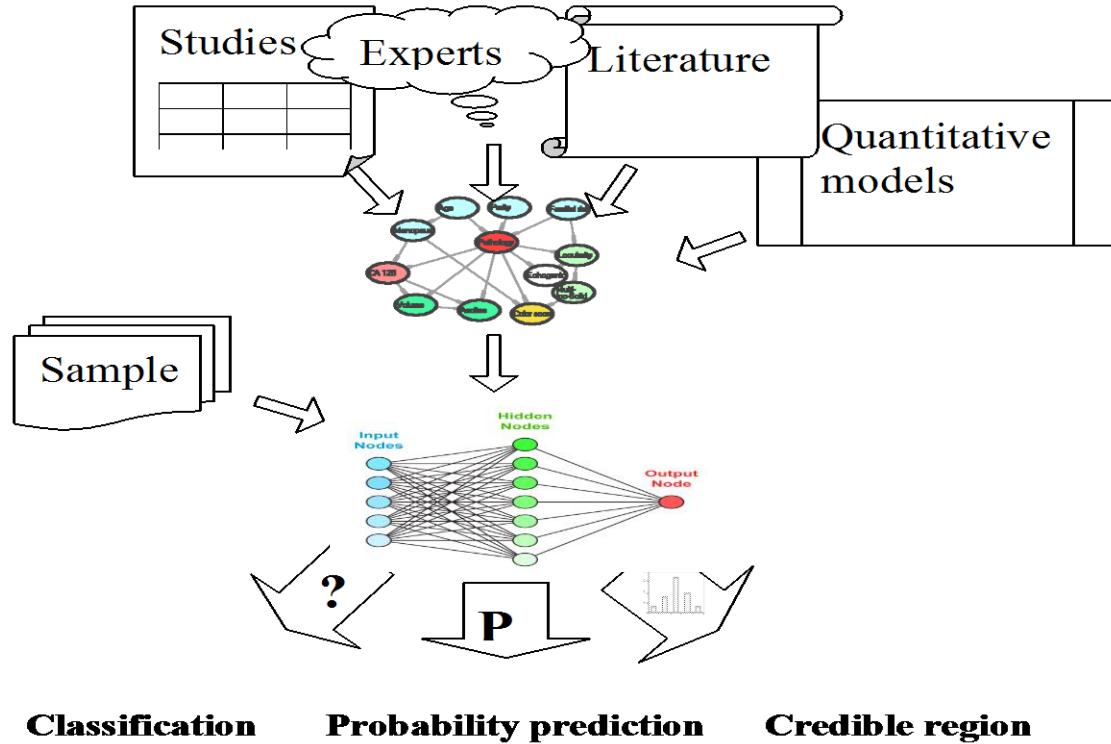
Antal, P. et al: Incorporation of prior knowledge in black-box models, In *Proc. of the Workshop on Fusion of Domain Knowledge with Data for Decision Support, The Sixteenth Conference on Uncertainty in Artificial Intelligence, 2000*

Data and knowledge fusion
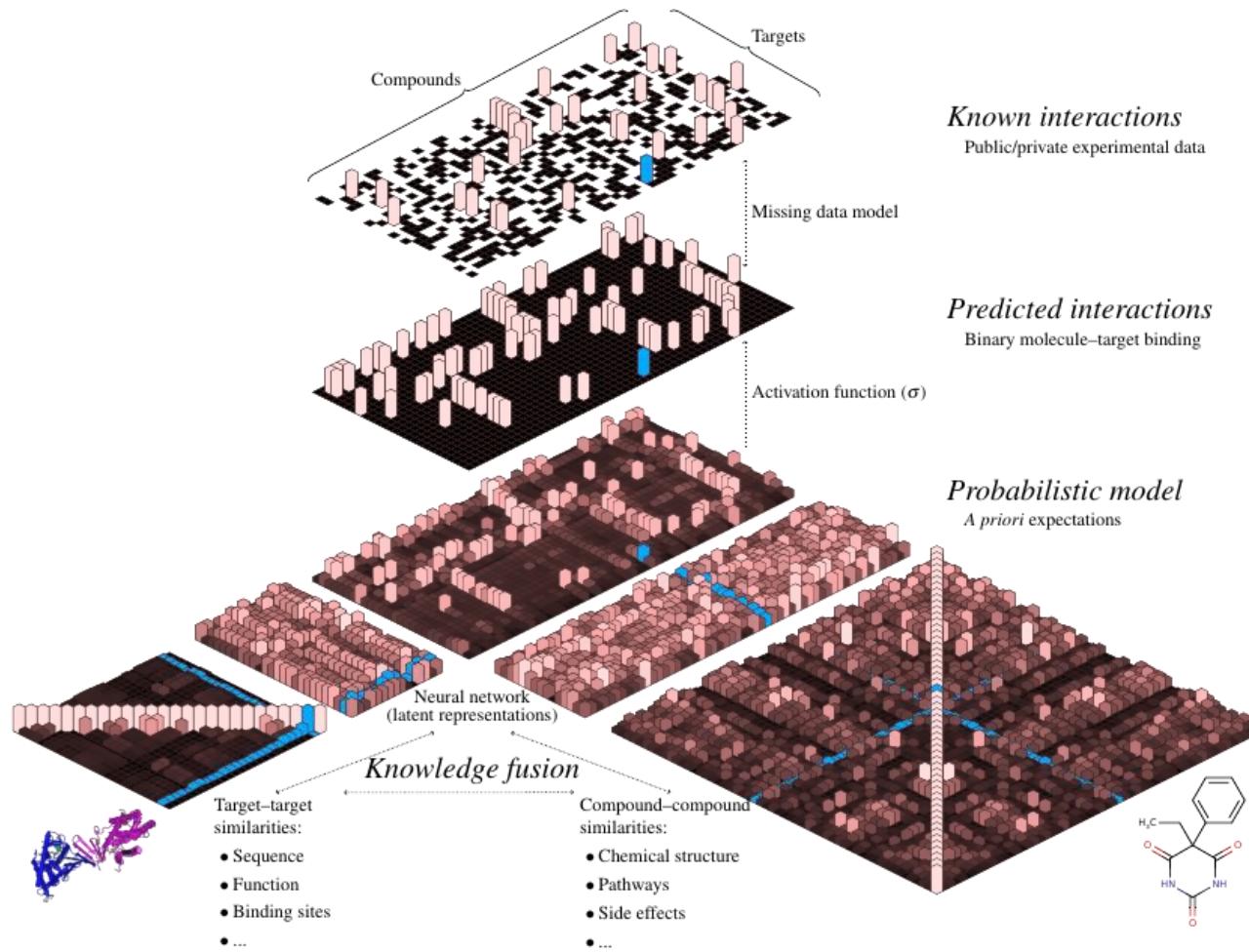
Bolgár, B. and Antal, P., 2017. VB-MK-LMF: fusion of drugs, targets and interactions using variational Bayesian multiple kernel logistic matrix factorization. *BMC bioinformatics*, *18*(1), p.440.

AI in medicine

Artificial intelligence
Machine learning
Biostatistics
Bioinformatics

BME & Semmelweis University:
Joint M.Sc. program
in Biomedical engineering

Research:
- Drug discovery
- Biomedical data analysis
- Image processing
- Sensor nets
- Genetic sequencing
- Statistical genetics
- Clinical decision support
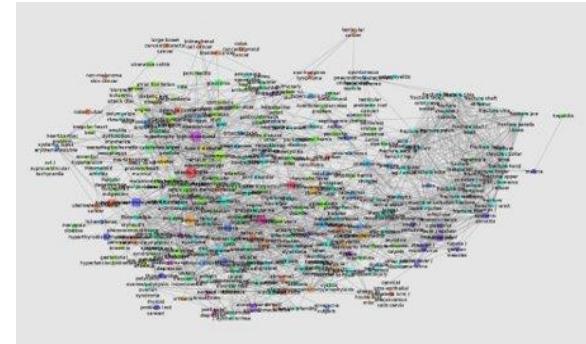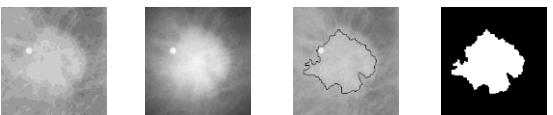
Futó projektek

De novo hatóanyagjelölt generálás nagy mennyiségű bioaktivitási információkat felhasználó mély megerősítéses tanulással: több szempont együttes optimalizálása mesterséges intelligenciával a korai gyógyszer-kutatásban. 2020-2021.

MELLODDY project: MachinE Learning Ledger Orchestration for Drug DiscoverY. **Federált mély tanuló algoritmusok a gyógyszerkutatásban**. 2019-2021.

HIDUCTION project, **Privacy preserving data and knowledge fusion** in personalized biomedicine, 2017-2019.

FROm empowering To Viable Living (Front-VL). **Kognitív képességek becslése,** változás detektálása számítógépes játékok segítségével időseknél, 2018-2019.

Reconfigurable ROS-based Resilient Reasoning Robotic Cooperating Systems (R5-COP). 2014-2017.

Történeti és irodalmi **természetes nyelvi anyagok statisztikai szövegelemzése**. 2019-2020.

Mesterséges intelligencia módszerek pénzügyi szövegek elemzésére

Köszönöm a figyelmet!

Viszontlátásra!

2020. 05. 18.