Symbiotic AI: combining knowledge and reasoning

Teacher(s)
Zafar Saeed

Course Website (optional)
https://classroom.google.com/
Code: *biuuwcc*

Course description (min 150, max 300 words)
Symbiotic AI systems are intended to enable humans to complement the AI system so that human inputs are used to improve the AI system's performance. Moreover, they can be empowered by knowledge-intensive components to be exploited for improved support of humans performing knowledge-intensive tasks. AI systems using knowledge graphs could be profitable in providing solutions that are effective and efficient. This course covers the following key aspects: First, it introduces knowledge graphs, their purpose, and practical applications. Next, it explores various encoding methods used as an input data for embedding techniques in downstream machine learning tasks such as triple classification and link prediction. The course then examines negative sampling approaches and discusses their limitations and challenges. Additionally, it discusses advanced deep learning-based embedding methods. Towards the end, the curriculum includes hands-on implementation of these techniques through a real-world case study and students will analyze how embedding methods can effectively address practical problems in different domains. The course blends theoretical concepts with practical applications for comprehensive learning.

Course period
Nov-Dec 2025

SSD
INF/01

Course References (optional)

1. R. Brachman and H. Levesque: Knowledge Representation and Reasoning. 2014
2. J. Z. Pan, An Introduction to Knowledge Graphs, Tutorial at the BIAS2021 summer school, 2021.
3. M. Nickel, K. Murphy, V. Tresp, and E. Gabrilovich: A Review of Relational Machine Learning for Knowledge Graphs. Proceedings of the IEEE, Volume 104
4. Online reference materials will be shared along the journey.

Credits and Hours
3 credits, 2 of lectures (16 hours) and one of practice (15 hour), for a total of 31 hours.

Exam Modality
Two alternatives are available to the student to pass this exam (Teacher(s) may choose other modalities):

1) Paper presentation. Students will choose and present the content of 2 papers published in reputable venues. No groups are allowed.
2) Students will implement and experimentally evaluate an algorithm (or a variation of it) based on a research paper/case study discussed during the course. Projects may be completed individually or in groups of up to three students, depending on the complexity of the chosen algorithm.

Teacher(s) CV

Find below links.

Zafar Saeed

Online Profiles:
Contact: +39-3888805363
Email: zafar.saeed@uniba.com
Office: LACAM Lab, 4th floor, Department of Computer Science, University of Bari

Teacher(s) CV

Attached below.

Teacher(s) Main Publications

1. Exploring the impact of SEO-based ranking factors for voice queries through machine learning, *Artificial Intelligence Review.* (IF 12, SJR: Q1, online-2024**)**
2. Towards understanding the role of content-based and contextualized features in detecting abuse on Twitter. *Heliyon.* (IF 4, SJR: Q1, online-2024**)**
3. Dynamic Bipartite Network Embedding for incorporating structural and attribute information. World Wide Web. 2023 Sep;26(5):3463-81. (IF 3.7, SJR: Q1, online-2023**)**
4. Energy theft detection in smart grids with genetic algorithm-based feature selection, *Computers, Materials & Continua*, 74(3), 5431–5446. (IF 3.86, SJR: Q2, online-2023**)**
5. Investigating cognitive workload in concurrent speech-based information communication, *International Journal of Human-Computer Studies, Vol: 157-102728.* (IF: 4.866, SJR: Q1, online-2022**)**
6. Enhanced heartbeat graph for emerging event detection on twitter using time series networks. *Expert Systems with Applications*, *136*, 115-132. (IF: 8.665, SJR: Q1, online-2020**)**
7. Evesense: what can you sense from twitter?. In *European Conference on Information Retrieval* (pp. 491-495). Lisbon, Portugal, Springer, Cham. (Core Rank: A, online-2020**)**
8. Event detection in Twitter stream using weighted dynamic heartbeat graph approach [application notes]. *IEEE Computational Intelligence Magazine*, *14*(3), 29-38. (IF: 9.809, SJR: Q1, online-2019**)**
9. What's happening around the world? a survey and framework on event detection techniques on twitter. *Journal of Grid Computing*, *17*(2), 279-312. (IF 4.674, SJR: Q1, online-2019**)**
10. Text stream to temporal network-a dynamic heartbeat graph to detect emerging events on twitter. In *Pacific-Asia Conference on Knowledge Discovery and Data Mining* (pp. 534-545). *Melbourne, Australia*, Springer, Cham. (Core Rank: A**,** online-2018**)**