

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. Challenges include costs, constraints, quality, and availability when using human inputs to complement the AI system and the need for the AI system to have some kind of complex reasoning capability to know how and when to use the human inputs effectively. The deployment of hybrid AI, which integrates data-driven with model-driven AI (knowledge representation, knowledge graphs, complex reasoning, and inference), and distributional and/or explicit semantics, is also crucial for this goal. Hybrid AI solutions could also be profitable in providing SAI solutions that are effective, efficient, and interpretable/understandable. Two main aspects are considered in this course: (i) including factors associated with costs, constraints, quality, and availability when using human inputs to complement the AI system; (ii) providing the AI system with complex reasoning capabilities on how and when to effectively use the human inputs.

Course period

Nov-Dec 2023

SSD

INF/01

Course References (optional)

[1] R. Brachman and H. Levesque: Knowledge Representation and Reasoning. Morgan Kaufmann 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

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 present the content of 2 papers suggested by the teacher. No groups are allowed.

- 2) Project. Students implement and experimentally validate an algorithm or its variation from a paper suggested/approved by the teacher. Projects can be done in groups of 1-3 students, depending on the algorithm.

Teacher(s) CV

Find below.

Teacher(s) Main Publications

1. 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](#))
2. 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](#))
3. 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](#))
4. A Novel Image Encryption Technique Based on Mobius Transformation, *Computational Intelligence and Neuroscience*. (IF: 3.9, SJR: Q1, [online-2021](#))
5. 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](#))
6. 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](#))
7. A Dynamic Three-Bit Image Steganography Algorithm for Medical and e-Healthcare Systems, *IEEE Access*, 8:181893-181903. (IF 3.476, SJR: Q1, [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](#))

Zafar Saeed

Education

- 2020 **Ph.D (Computer Science)**, Quaid-i-Azam University, Islamabad, Pakistan
Thesis: Detecting Unspecified Events on Twitter
- 2018 **Ph.D (Visiting Scholar)**, University of Technology Sydney, Australia
Thesis: Detecting Unspecified Events on Twitter
- 2010 **M.Phil (Computer Science)**, Quaid-i-Azam University, Islamabad, Pakistan.
Thesis: Usable Layout for Scientific Documents to Support Online Reading
- 2007 **BS(Computer Science)**, BUITMS, Quetta, Pakistan.
- 2001-02 **Diploma in IT and Diploma in .Net Technologies**, BIIT, Quetta, Pakistan.

Teaching Experience

Assistant Professor, University of Central Punjab, LHR, Pakistan **(09/2020 – 06/2022)**

Courses Taught: Operating Systems, Emerging Trends in Information Retrieval, Big Data Analytics, Natural Language Processing, Artificial Intelligence.

Course Coordinator: Designing course outlines, monitoring teaching activities, managing, and leading the course instructors to uphold the quality of teaching environments. Coordinating three courses: Introduction to Data Science, Big Data Analytics, Data Analysis Techniques.

Research and Collaboration: Organizing faculty's research seminars, coordinating with the external institutes for research and collaboration.

Course Curriculum: Designing new course curriculum for bachelor's and master's programs in Data Science such as Social Network Analysis and Social Media Content Analysis.

Thesis Supervised:

Ushtar Ali, Sentiment analysis on political tweets using graph embedding (MSCS-2022)

Fozia Aslam, Impact of SEO-based ranking factors for voice queries through machine learning (MSCS-2021)

Lecturer, University of Central Punjab, LHR, Pakistan **(10/2012 - 02/2013)**

Courses Taught: Data Structures, Discrete Structures

Lecturer (Visiting)

Quaid-i-Azam University, ISB, Pakistan **(09/2009 - 02/2011) & (09/2018 - 06/2019)**

Courses Taught: Intro. to Computer Systems, Problem Solving and Programming, Object Oriented Programming

University of Technology Sydney, Australia **(03/2018 - 06/2018)**

Course Taught: Data Structures and Algorithms

Air University, ISB, Pakistan **(02/2015 - 06/2015)**

Courses Taught: Data Structures, Programming Fundamentals

Arid Agriculture University, RWP, Pakistan **(02/2013 - 01/2015)**

Courses Taught: Modern Programming Languages, Software Engineering

Federal Urdu University of SA & Tech, ISB, Pakistan **(02/2012 - 01/2013)**

Courses Taught: Visual Programming, Distributed Databases

Professional Experience

Software Developer, Acoem (Ecotech Pty Ltd), Melbourne, Australia (06/2022 – Present)

Responsibilities:

- Design, development, and integration of software features for Airodis
- Maintenance and enhancement of the software products which are used for weather data analytics
- Design and implementation of service-oriented AirodisX – a cloud-based system for AQMS

Tech Stack:

- C#, VB.Net, .Net Core, .Net Microservice Architecture, Entity Framework, WCF, SSH.Net, Fluent API, SOAP/RESTful APIs, AutoMapper, WinForms, JSON, XML, TOML, SQLite, SQLCe, SQL Server, VS.Net, Jira, Confluence, Jenkins (CI/CD), GitHub, GitKraken

Software Developer, Advanced Analytics Institute, UTS, Sydney, Australia (07/2017 - 06/2018)

Responsibilities:

- Development of novel graph-based methods to transform text stream.
- Design and development of FinQ - an AI-powered micro-finance application.

Tech Stack:

- Python, MongoDB, Scikit-learn, Pandas, numpy, NLTK, tweepy, networkX, Google Cloud Platform (GCP), PHP, Codelgniter, RESTful APIs, JSON, Bootstrap, HTML5, MySQL, AWS(S3, EC2, RDS), GitHub

Software Engineer, Diyatech, Islamabad, Pakistan (02/2012 - 10/2012)

Responsibilities:

- Development, integration, and maintenance of software NCache
- analyzing newly developed features for evaluating system performance
- Writing source code for the integration of end-users' APIs with the existing software application

Tech Stack:

- C#, SQL Server, PostgreSQL, Sockets, Protocol Buffers, SOAP, VSS, Bugzilla

Software Engineer, M-Net Technologies, Islamabad, Pakistan (07/2010 - 02/2012)

Responsibilities:

- Project initialization, requirement gathering, design and development
- Writing efficient and scalable software source code
- Testing the source code, debugging for the error tracing, and ensuring the quality
- Time and cost estimation, resource allocation and client communication.

Tech Stack:

- ASP.Net, C#, VB.Net, Infragistics, Crystal Reports, Entity Framework, MVC, SQL Server, VS.Net, VSS

Project Developer, BUIITEMS, Quetta, Pakistan (04/2006 - 04/2007)

Responsibilities:

- Design and development of security system for computer laboratories
- Reading data from ground sensors and laser sensors
- Controlled visual surveillance, and secure entrance & exit

Tech Stack:

- C#, VB.Net, Infragistics, Crystal Reports, SQL Server, parallel port programming

Research Interests and Publications

- Data science, machine learning, text mining, and Knowledge Graph
- Information extraction and retrieval systems
- Social computing (Social Network Analysis, Social Media Analytics)

Published  [citations?user=o99g-7oAAAAJ&hl=en](https://scholar.google.com/citations?user=o99g-7oAAAAJ&hl=en)

Under-Review

1. Evaluating the intertwined impact of SEO on voice search ranking factors through Machine Learning - Artificial Intelligence Review (IF 12.0, SJR: Q1, 2023)

2. Abusive Tweets Detection using Supervised Learning with Contextual Features - Heliyon (IF 3.776, SJR: Q1, 2023)

In-Progress

1. Social Network Analysis of Russia-Ukraine War based on Twitter Data - (Tentative Sub: Jan-2024)
2. Identifying Conspiracy Theories in Twitter based on Deep Learning - (Tentative Sub: Feb-2024)

Workshops and Events

- Training workshop on “Enhancing Research Productivity”, organized by University of Central Punjab, Lahore, Pakistan, held on 25th September 2021
- Training workshop on “Teaching Excellence Program”, organized by University of Central Punjab, Lahore, Pakistan, held on 30th August 2021 to 2nd September 2021
- Conference Talk on “What can we sense from Twitter”, ECIR’20, Lisbon, Portugal.
- Workshop on “Use of Artificial Intelligence Against COVID-19”, organized under China-Pakistan Science Workshop by PASTIC, QAU, Pakistan and BTBU China, held on 23rd July 2020.
- Training workshop on "Introduction to teaching first year subjects ", organized by Institute for Interactive Media and Learning, University of Technology Sydney, held on 26th March 2018
- Training workshop on "Active learning in UTSONline”, organized by Institute for Interactive Media and Learning, University of Technology Sydney, held on 27th March 2018
- Training workshop for casual academics on "Tools for Online Feedback”, organized by Institute for Interactive Media and Learning, University of Technology Sydney, held on 28th March 2018
- Conference Talk on “Text Stream to Temporal Network”, PAKDD’18, Malborne, Australia.
- Poster Presentation in Faculty of Engineering & IT Research Showcase event, organized by FEIT, University of Technology Sydney, held on 14th June, 2018

Community Services

Invited Reviewer:

- International Conference on Computer Modeling and Big Data Analytics (CMBDA’22), China
- Pacific Rim International Conference on Artificial Intelligence (PRICAI’18), China
- Int. Conference on Advances in Social Networks Analysis and Mining (ASONAM’18), Spain
- IEEE International Conference on Big Data Science and Engineering, (BigDataSE’18), USA

Reviewing for Journals:

- Expert Systems with Applications, Elsevier
- Geo-Spatial Information Science, Taylor & Francis

Awards

- **Student Grant** by 42nd European Conference on Information Retrieval (ECIR’2020)
- **Research fellowship** by Advanced Analytics Institute, **University of Technology Sydney**, Australia. (Feb 2018 - July 2018)
- **Research funding** for the foreign research visit under **International Research Support Initiative Program** by the Higher Education Commission (HEC), Pakistan. (Aug 2017-Jan 2018)
- **Ph.D. Fellowship** by Higher Education Commission (HEC), Pakistan (Feb 2013-Jul 2017)
- **Merit scholarship** in M.Phil, Department of Computer Science, **Quaid-i-Azam University**, Islamabad, Pakistan. (2007-2008)