

Example of a course proposal

Advanced Topics in AI: Machine Learning, Symbiotic AI, and Behavioral Biometrics

Teacher(s)

Vincenzo Dentamaro

Course Website (optional)

[Advanced Topics in AI: Machine Learning, Symbiotic AI, and Behavioral Biometrics | Generale | Microsoft Teams](#)

Course description

This doctoral course offers an in-depth investigation into leveraging artificial intelligence to transform detection, diagnosis, and treatment of neurodegenerative diseases. Through interactive lectures and hands-on analysis, students critically assess high-impact machine learning techniques and frameworks to extract insights from multimodal brain data. Example focus areas include applying deep neural networks to elucidate early biomarkers from MRI, PET scans, genetics, and cognitive assessments. Contrastive case studies analyze AI-driven neurodegenerative disease projects - spanning Alzheimer's, Parkinson's, ALS and more – evaluating success factors and pitfalls behind clinical adoption versus abandonment.

Students examine state-of-the-art research around employing AI for digital phenotyping, personalized brain network mapping, clinical trial optimization, and drug discovery pipelines. Additional topics include investigating the potential of symbiotic brain-computer interfaces and hybrid AI-human expert systems to augment clinician capabilities. By course completion, students can strategically evaluate new machine learning techniques and frameworks for neurodegenerative disorders through an integrative lens, synthesizing insights across imaging, genetics, cognitive and demographic datasets. The doctoral project facilitates specialization into a key challenge at the intersection of AI-driven neurodegeneration advances, frontline care integration, and equitable patient access.

Course period

September-October 2024

SSD

IINF-05/A

Credits and Hours

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

Exam Modality

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

Teacher(s) CV



VINCENZO DENTAMARO is an assistant professor at the University of Bari. He received the degree in computer science from the Department of Computer Science, University of Bari, Italy in 2012, and the M.Sc. degree in machine learning from the Georgia Institute of Technology, Atlanta, GA, USA in 2019. He received a PhD in computer science from the University of Bari with a scholarship offered by InnovaPuglia S.p.A. in 2022. He was a Software Engineer at Johnson Controls Inc. Milan; an Intern at IBM Rome; and the CEO and CTO Nextome S.R.L in Conversano. He is currently publishing in various pattern recognition journals and conferences. He is associated editor for the Springer-Nature journal *Multidimensional Systems and Signal Processing*. He is also a Reviewer of IEEE Access, Elsevier Pattern Recognition Journal, MDPI Sensor, MDPI Information, and so on. He has previously published about indoor positioning and localization techniques on Microsoft Research Journal and holds two international patents on localization technologies. His awards and honors include the 1st prize Busan Metropolitan City, South Korea, in the Seal of Excellence European Commission; IBM's Global Mobile Innovator Tournament Award at the Mobile World Congress; and the MIT Technology Review award

Teacher(s) Main Publications

1. Dentamaro, V., Giglio, P., Impedovo, D., Pirlo, G., & Di Ciano, M. (2024). An interpretable adaptive multiscale attention deep neural network for tabular data. *IEEE Transactions on Neural Networks and Learning Systems*, 1–15. <https://doi.org/10.1109/TNNLS.2024.3392355>
2. Coscia, A., Dentamaro, V., Galantucci, S., Maci, A., & Pirlo, G. (2024). Automatic decision tree-based NIDPS ruleset generation for DoS/DDoS attacks. *Journal of Information Security and Applications*, 82, 103736.
3. Coscia, A., Dentamaro, V., Galantucci, S., Maci, A., & Pirlo, G. (2023). YAMME: a YARA-byte-signatures Metamorphic Mutation Engine. *IEEE Transactions on Information Forensics and Security*.
4. Dentamaro, V., Giglio, P., Impedovo, D., Moretti, L., & Pirlo, G. (2022). AUCO ResNet: an end-to-end network for Covid-19 pre-screening from cough and breath. *Pattern Recognition*, 127, 108656.
5. Dentamaro, V., Gattulli, V., Impedovo, D., & Manca, F. (2024). Human Activity Recognition with Smartphone-Integrated Sensors: A Survey. *Expert Systems with Applications*, 123143.
6. Coscia, A., Dentamaro, V., Galantucci, S., Maci, A., & Pirlo, G. (2023). An innovative two-stage algorithm to optimize Firewall rule ordering. *Computers & Security*, 134, 103423.
7. Cheriet, M., Dentamaro, V., Hamdan, M., Impedovo, D., & Pirlo, G. (2023). Multi-speed transformer network for neurodegenerative disease assessment and activity recognition. *Computer Methods and Programs in Biomedicine*, 230, 107344.
8. Impedovo, D., Dentamaro, V., Abbattista, G., Gattulli, V., & Pirlo, G. (2021). A comparative study of shallow learning and deep transfer learning techniques for accurate fingerprints vitality detection. *Pattern Recognition Letters*, 151, 11-18.
9. Dentamaro, V., Impedovo, D., & Pirlo, G. (2020). Gait analysis for early neurodegenerative diseases classification through the kinematic theory of rapid human movements. *IEEE Access*, 8, 193966-193980.
10. Cicirelli, G., Impedovo, D., Dentamaro, V., Marani, R., Pirlo, G., & D'Orazio, T. R. (2021). Human gait analysis in neurodegenerative diseases: A review. *IEEE Journal of Biomedical and Health Informatics*, 26(1), 229-242.

Teacher(s) CV



VINCENZO DENTAMARO is an assistant professor at the University of Bari. He is a distinguished scholar and practitioner in the fields of computer science and artificial intelligence, with a particular emphasis on machine learning applications in healthcare and neurodegenerative diseases. He holds a Ph.D. in Computer Science from the University of Bari Aldo Moro, and an MSc in Computer Science with a specialization in Machine Learning from the Georgia Institute of Technology. Dr. Dentamaro has an extensive academic and professional background, characterized by significant contributions to research, teaching, and industry.

Education:

- **Ph.D. in Computer Science (cum laude)**
University of Bari Aldo Moro, Italy
November 2022
- **Master of Science in Computer Science (Machine Learning Specialization)**
Georgia Institute of Technology, Atlanta, USA
GPA: 3.7/4.0
Duration: 2.5 years
- **Bachelor's Degree in Computer Science and Technologies for Software Production**
University of Bari Aldo Moro, Italy
Grade: 107/110
- **Industrial Technical Expert Diploma**
M. Panetti, Bari, Italy
Grade: 100/100

Academic and Teaching Experience: Dr. Dentamaro has held several teaching positions, delivering courses on artificial intelligence, machine learning, and related subjects at the University of Bari Aldo Moro and other institutions. He has supervised numerous bachelor's and master's theses and has been involved in doctoral tutoring. His teaching portfolio includes:

- **Courses Taught:**
 - Basics of Artificial Intelligence and Machine Learning
 - Symbiotic AI: Case Studies in Challenging Domains
 - Behavioral Biometrics for Healthcare Security
- **Invited Seminars and Lectures:**
 - Artificial Intelligence for Healthcare (Ecole de Technologie Superieur, Montreal)

- Neurodegenerative Diseases Assessment and Artificial Intelligence (Stanford University)

Research and Publications: Dr. Dentamaro's research interests focus on the application of AI and machine learning to healthcare, particularly in the assessment and diagnosis of neurodegenerative diseases. He has been a principal investigator in several funded research projects and has published extensively in high-impact journals and conferences.

- **Recent Publications:**

- An Interpretable Adaptive Multiscale Attention Deep Neural Network for Tabular Data (IEEE Transactions on Neural Networks and Learning Systems, 2024)
- Integrating Human Expertise & Automated Methods for Clinical Decision-Making (International Journal of Medical Informatics, 2024)

- **Research Projects:**

- Scientific Manager of the NXTracker project (Nextome Srl)
- Scientific Manager of the Mosaicos project (Nextome Srl)

Professional Experience:

- **Chairman of the Board of Directors, Nextome Srl**

December 2013 – Present

Dr. Dentamaro leads the development of innovative indoor positioning systems, leveraging machine learning for signal processing and user movement recognition. Nextome has received multiple accolades for its technological advancements.

- **Co-Founder and CTO, Bull Prediction Srl**

June 2015 – September 2017

Developed predictive analytics tools for stock market trends using machine learning algorithms.

- **Software Engineer, Johnson Controls**

August 2011 – July 2013

Worked on advanced warning systems for airports and energy consumption forecasting using neural networks.

Editorial and Reviewing Activities:

- Associate Editor, Multidimensional Systems and Signal Processing (Springer Nature)
- Guest Editor, MDPI Mathematics - Special Issue on Advances in Deep Learning for Pattern Recognition
- Reviewer for several prestigious journals including IEEE Access, Elsevier Pattern Recognition, and MDPI Sensors.

Awards and Recognitions:

- Winner, Huawei University Challenge Italy 2021 (Embedded AI Category)
- Most Awesome Alpha Startup, Nextome, Dublin 2014
- Indoor Positioning Expert, Place Conference, New York 2015
- First Prize, Busan Smart City Innovator, South Korea 2016
- Global Innovator Expert, IBM Glovators for Smart Cities, Barcelona 2016
- Mention of Merit, Industria Felix Award, 2016

Patents: Dr. Dentamaro holds several patents in the field of indoor positioning and machine learning applications, showcasing his ability to innovate and lead cutting-edge technological advancements.

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1. Dentamaro, V., Giglio, P., Impedovo, D., Pirlo, G., & Di Ciano, M. (2024). An interpretable adaptive multiscale attention deep neural network for tabular data. *IEEE Transactions on Neural Networks and Learning Systems*, 1–15. <https://doi.org/10.1109/TNNLS.2024.3392355>
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