Beatrice Amico

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Current position: Assistant professor, University of Verona
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Previous position(s)

November 2022 – March 2025 PostDoc researcher, Department of Computer Science, University of Verona, Italy

Education

- Ph.D. in Computer Science, University of Verona, May 2023
  Thesis: *Explainable temporal data mining techniques to support the prediction task in medicine.*
- Master's Degree in Medical Bioinformatics, Department of Computer Science, University of Verona, Advisor: Prof. Carlo Combi, March 2019
  Thesis: *Modelling and interactive visualization of latent class trajectories: application for precision medicine in Rheumatoid Arthritis*
- Bachelor's degree in Bioinformatics, Department of Computer Science, University of Verona, Advisor: Prof. Carlo Combi, November 2016
  Thesis: *Design and creation of reports for the analysis of data from an Immunology laboratory*

Research Interests

Temporal data mining

- Conceptual modeling of data;
- Functional dependencies;
- Representation and management of temporal aspects;
- Predictive patterns.

Temporal knowledge discovery in medicine

- Modeling and management of temporal aspects in clinical data;
- Temporal knowledge discovery from heterogenous clinical data.

Explainability and temporal data

- Explainability of Temporal Decision Support Systems: Taxonomy and Challenges.

Design and implementation of biological databases

- Data and process analysis to support biodiversity research.

Temporal data mining

Database systems enable us to store huge quantities of data. Their analysis through data mining techniques provides the possibility to extract relevant knowledge and useful hidden information. Temporal data mining has a major scope in the discovery of potential hidden knowledge from large amounts of data, offering the possibility to identify different features that are less visible or hidden in common analysis techniques. The most important topic during my Ph.D. is based on showing how temporal data mining, precisely mining functional dependencies, can be fruitfully exploited to improve prediction. We proposed a methodology for deriving a new kind of approximate temporal functional dependencies, called Approximate Predictive Functional Dependencies(APFDs), [C4], [C5],[C6]. We explored the concept of approximation, introducing different measures of approximation essential when we use data from the real world. We introduced a new temporal framework based on three temporal windows designed to extract predictive information, where the novelty is reasoning on a third window between the observation window, where we collect the data, and the prediction window, where the predicted event occurs. And finally, we partially investigated the data complexity of deriving an APFD, and how to evaluate the quality of APFDs in terms of coverage and reliability [J2].

Temporal knowledge discovery in medicine

Besides the temporal data mining techniques, another research interest is applying these techniques in the clinical context [BC2]. Clinical databases gather large volumes of data. Associations and patterns within these data could provide new medical knowledge. The massive amount of data derived from electronic medical records is often under-utilized. The analysis of healthcare/medical data collections could greatly help to gain a deeper insight into the health conditions of the population and extract useful information that can be exploited in the assessment of healthcare/medical processes. An important aspect that has to be considered is the intrinsic necessity to take into account the temporal dimension, often related to the meaning of the data. By collaborating with domain experts, We had the opportunity to share my results with the scientific community of physicians and medical informatics experts [T1], [C3].

Explainability and temporal data

In the manifesto [J4], we explored in depth the concept of explainable AI, offering a functional definition and conceptual framework or model that can be used when considering XAI. This is followed by a series of desiderata for achieving explainability in AI, each of which touches upon a key domain in biomedicine. Considering that one of the central topics in my research is the temporal aspect, in the context of my Ph.D. thesis [D1], I discussed the meaning of temporality in the XAI context, explicitly declining different aspects of it.

Ethical considerations in BPM

Recently, we have started to explore a new research direction, the fairness in BPM [C2]. Ethics in data management has become a challenging topic since it is essential to ensure the responsible treatment of information. This work highlights the importance of integrating fairness in PAISs where data-intensive business process models must be suitably designed, considering fairness criteria instead of revealing unfair policies with successive data analysis. The proposal delineates an integrated approach to data and process modeling, which explicitly considers fairness in data and process management.

Research Activities

Conference talks

2024

- *Interpretable Temporal Data Mining for Clinical Decision-Making*, Tutorial at AMIA 2024, American Medical Informatics Association Annual Symposium, San Francisco, USA
- *Enhancing BPMN models with ethical considerations*, EDOC Forum 2024- 28th International Conference on Enterprise Design, Operations, and Computing, Wien, Austria

2023

- *Discovering predictive temporal patterns for Acute Kidney Injury from critical care data*, AMIA 2023, American Medical Informatics Association Annual Symposium, New Orleans, USA
- *Discovering predictive dependencies on multi-temporal relation*, TIME 2023, 30th International Symposium on Temporal Representation and Reasoning, Athens, Greece
- *Supporting the Prediction of AKI Evolution Through Interval-Based Approximate Predictive Functional Dependencies*, AIME 2023, 21st International Conference on Artificial Intelligence in Medicine, Portoroz, Slovenia

2022

- *A 3-Window Framework for the Discovery and Interpretation of Predictive Temporal Functional Dependencies*, AIME 2022, 20th International Conference on Artificial Intelligence in Medicine, Halifax, NS, Canada

2019

- *A Dashboard for Latent Class Trajectory Modelling: application in Rheumatoid Arthritis*, MEDINFO 2019, 17th World Congress of Medical and Health Informatics, Lyon, France

Awards

- Best Student Paper, A 3-Window Framework for the Discovery and Interpretation of Predictive Temporal Functional Dependencies. Amico B, Combi C., AIME 2022, 20th International Conference on Artificial Intelligence in Medicine, Halifax, NS, Canada

Editorial Boards

- Editorial board member, Artificial Intelligence in Medicine, January 2026- ongoing
- Guest editor of the special issue *Artificial Intelligence in Medicine: Special issue on Advancing Temporal Knowledge Discovery in Clinical Data from PhysioNet databases* in Artificial Intelligence in Medicine (AIIM), Elsevier, December 2024 Ongoing
- Managing editor, Artificial Intelligence in Medicine (AIIM), Elsevier, March 2021 – December 2025
- Student editorial board, Methods of Information in Medicine, Thieme, July 2021-May 2023

Committees

- Chair of FEDHA – International Workshop on Fairness Exploration in Heterogeneous Data and Algorithms at European Conference on Advances in Databases and Information Systems (ADBIS) 2025 (First edition), ADBIS 2026 (Second edition)
- Program Committee Member - TIME 2024, 2025, 2026, International Symposium on Temporal Representation and Reasoning
- Poster and demo chair - IEEE International Conference on Healthcare Informatics (IEEE ICHI 2025)
- Program Committee Member - 2024 SIAM International Conference on Data Mining (SDM 2024)
- Technical Program Committee - Workshop on Data Privacy and Data Analysis in Healthcare Systems (IEEE ICHI 2024)
- Technical Program Committee - Workshop on Big Data Analytic in Healthcare (IEEE BigData 2023)

Review Activity

IEEE ICHI 2021, Journal of Artificial Intelligence in Medicine, Conference on Knowledge Discovery and Data Mining (KDD) 2025

Research experiences

- Erasmus + Traineeship at Health eResearch Centre, Manchester University, March 2018 - July 2018, Advisors: Niels Peek, Arianna Dagliati
- Internship at Department of Immunology, Azienda Ospedaliera Universitaria Integrata di Verona, November 2015 - October 2016, Advisors: Carlo Combi, Antonio Vella

Co-Supervised Theses and Projects

Bachelor's Theses

- Sebastiano Mazzaro, *Analysis of clinical histories through random forests*, Bachelor's Degree in Computer Science, Department of Computer Science, University of Verona, ongoing.
- Marco Zordan, *Dashboard Development for the Analysis of the International Standard Classification of Occupations (ISCO)*, Bachelor's Degree in Computer Science, Department of Computer Science, University of Verona

- Desirè Castellani, *Dashboard Development for the Analysis of European Skills*, Competences, Occupations and Qualifications (ESCO) Bachelor's Degree in Computer Science, Department of Computer Science, University of Verona
- Mattia Danese, *Design and Development of an Interactive Dashboard for the Modeling and Analysis of Acute Kidney Injury Data*, Bachelor's Degree in Computer Science, Department of Computer Science, University of Verona
- Tommaso Bellè, *Querying Clinical Graph Databases: Analysis of Intensive Care Data (MIMIC-III) Using Cypher (Neo4j)*, Bachelor's Degree in Computer Science, Department of Computer Science, University of Verona

Master's Theses

2026

- Tommaso Fornoli, *Exploration of temporal histories in graph databases*, Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona, ongoing.
- Mohaddeseh Keshavarz, *Prompt Engineering for clinical data analysis*, Master's Degree in Artificial Intelligence, Department of Computer Science, University of Verona
- Stefano Tanfoglio, *A metadata-based framework for dataset similarity and linking*, Master's Degree in Computer Science and Engineering, Department of Computer Science, University of Verona

2025

- Amanda Businarolo, *Design and implementation of a web system to support biological research in Biodiversity*, Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona
- Chiara Dani, *BPMN-based representation of workflows to support biological research in Biodiversity*, Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona

2024

- Irene Fattori, co-supervisor with Prof. Carlo Combi, *Data Profiling and Electronic Health Records An Application to MIMIC-IV Database*, Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona
- Adelina Vivaldo, co-supervisor with Prof. Carlo Combi, *Representing healthcare records through knowledge-oriented shareable data models Mapping MIMIC-III to RDF* Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona
- Alberto Stevanella, co-supervisor with Prof. Carlo Combi, *Design and implementation of a relational database to support biological research towards Biodiversity*, Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona

2022

- Sara Maffessoli, co-supervisor with Prof. Carlo Combi, *Prediction of Acute Kidney Injury through approximate predictive functional dependencies. Some experiments on MIMIC-III database*, Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona

2021

- Isabela Alexandra Chiorean, co-supervisor with Prof. Carlo Combi and Prof. John Holmes, *Prediction of Acute Kidney Injury in Critical Care Unit. A reproducible ETL approach for window-based prediction and some preliminary results with Support Vector Machines*, Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona
- Marco Zandon, co-supervisor with Prof. Carlo Combi and Dott. Matteo Mantovani, *Discovering mixed trend-event features (M-TEF) in MIMIC-III, an open-access Intensive Care Unit database* ,Master's Degree in Medical bioinformatics, Department of Computer Science, University of Verona

Students Projects

2023

- Alberto Stevanella, Conceptual modeling of a relational database to support scientific research towards biodiversity
- Stefano Tanfoglio, Simone Scaglia, Implementation of an algorithm to mine the Approximate Predictive Functional Dependencies

2022

- Silvia Astorino, MIMIC-IV: ETL procedures implementation for temporal data mining techniques
- Chiara Solito, Extraction of temporal functional dependencies for Acromegaly
- Giorgio Dolci, Implementation of an alternative version of TANE: an algorithm for Approximate Predictive Functional Dependencies

Research groups and projects

Research groups

Databases and Information Systems group, Department of Computer Science, University of Verona

Projects

National **B**iodiversity **F**uture **C**enter, PNRR M4C2 Inv.1.4, NextGenerationEU, Topic: Design and implementation of a Data Warehouse system and data and process analysis for the integrated management of chemical, biological, and genetic data to support biodiversity research. Role: Responsible for the Design and Implementation of a biological database to support the Italian Biodiversity Research, November 2022-March 2025

Teaching activities

Courses

- Databases – Laboratory, second-year Bachelor's degree in Computer Science, University of Verona, A.A. 2025/2026, 2 CFU, INF/01 - INFORMATICS, professor.
- Databases – Laboratory, third-year Bachelor's degree in Computer Science, University of Verona, A.A. 2025/2026, 2 CFU, INF/01 - INFORMATICS, professor.
- Database technologies – Laboratory, Bachelor's degree in Bioinformatics, University of Verona, A.A. 2025/2026, 2 CFU, INF/01 - INFORMATICS, professor.
- Medical Informatics, Bachelor's degree in Human Centered Medical System Engineering, A.A. 2024/2025, 6 CFU, ING-INF/05 - INFORMATION PROCESSING SYSTEMS, professor.
- Documental Information Technology, Bachelor's degree in Communication Studies, A.A. 2023/2024, 6 CFU, INF/01 - INFORMATICS, professor.

Seminars

2024

- "Introduction to MIMIC-III Database and query examples ", Biomedicine and bioinformatics databases, Master's Degree in Medical bioinformatics, April 19, 2024
- "PostgreSQL and PgAdmin", Biomedicine and bioinformatics databases Biomedicine and bioinformatics databases, Master's Degree in Medical bioinformatics, April 17, 2024

2023

- "Explainable temporal data mining techniques to support the prediction task in Medicine", Biomedicine and bioinformatics databases, Master's Degree in Medical bioinformatics, May 17, 2023

2022

- "MIMIC III: query examples", Biomedicine and bioinformatics databases, Master's Degree in Medical bioinformatics, April 28, 2022
- "Introduction to MIMIC-III Database", Biomedicine and bioinformatics databases, Master's Degree in Medical bioinformatics, April 8, 2022
- "PostgreSQL and PgAdmin", Biomedicine and bioinformatics databases Biomedicine and bioinformatics databases, Master's Degree in Medical bioinformatics, April 7, 2022

Teaching assistant activities

- "Algorithms", Bachelor's degree in Bioinformatics, Department of Computer Science (University of Verona), Prof. Roberto Posenato, March 2022 - July 2022
- "Algorithms", Bachelor's degree in Bioinformatics, Department of Computer Science (University of Verona), Prof. Roberto Posenato, October 2020 - July 2021
- "Databases", Bachelor's degree in Computer Science, Department of Computer Science (University of Verona), Prof. Roberto Posenato, March 2020 - July 2020

Publications

2026

[J1] **Beatrice Amico**, Combi Combi, Mauro Commisso, Stefano Negri, Flavia Guzzo. Design and implementation of a web-based platform for biodiversity valorization data management: from process modeling to user-centred evaluation. Database (Oxford). 2026 Jan 15;2026:baag052. doi: 10.1093/database/baag052. PMID: 42725858; PMCID: PMC13563465.

[BC1] **Beatrice Amico**, Combi Combi, Matteo Mantovani, From Data to Decisions: XAI and LLMs for Data-Intensive Healthcare. Patron, 2026, GNB XLV Annual School 2026 – Generative AI for Bioengineering

2025

[C1] **Beatrice Amico**, Carlo Combi, Knowledge Graphs for Clinical Data: Strategies and Challenges with an Application to MIMIC III Dataset, International Conference on Artificial Intelligence in Medicine. Cham: Springer Nature Switzerland, 2025.

2024

[T1] **Beatrice Amico**, Carlo Combi, Arianna Dagliati, Lucia Sacchi, John Holmes, Interpretable temporal data mining for clinical decision-making, AMIA 2024 Annual Symposium, San Francisco, USA, November 9-13, 2024, Proc. in press

[C2] **Beatrice Amico**, Carlo Combi, Anna Dalla Vecchia, Sara Migliorini, Barbara Oliboni, Elisa Quintarelli, Enhancing BPMN models with ethical considerations, EDOC Forum 2024, 28th International Conference on Enterprise Design, Operations, and Computing, Wien, Austria, September 10-13, 2024, Proc. in press

[J2] **Beatrice Amico**, Carlo Combi, Romeo Rizzi, Pietro Sala, Predictive mining of multi-temporal relations. Inf. Comput. 301: 105228 (2024), doi: 10.1016/J.IC.2024.105228, SJR 2023 Quartile: Information Systems Q2

[J3] Salvatore Crisafulli, Andrea Fontana, Luca L'Abbate, Giacomo Vitturi, Alessia Cozzolino, Daniele Gianfrilli, Maria Cristina De Martino, **Beatrice Amico**, Carlo Combi, Gianluca Trifirò, Machine learning-based algorithms applied to drug prescriptions and other healthcare services in the Sicilian claims database to identify acromegaly as a model for the earlier diagnosis of rare diseases, Nature-Scientific Reports, Vol. 14, Article number: 6186, 2024, doi: 10.1038/s41598-024-56240-w, SJR 2023 Quartile: Multidisciplinary Q1

2023

[C3] **Beatrice Amico**, Carlo Combi, Giovanni Gambaro: Discovering predictive temporal patterns for Acute Kidney Injury from critical care data, AMIA 2023 Annual Symposium, New Orleans, USA, November 11-15, 2023, Proc. 2024 Jan 11; 2023:261-269.

[C4] **Beatrice Amico**, Carlo Combi, Romeo Rizzi, Pietro Sala: Discovering predictive dependencies on multi-temporal relation, TIME 2023, 30th International Symposium on Temporal Representation and Reasoning, Athens, Greece, September 25-26, 2023 LIPIcs, Volume 278, pp. 4:1-4:19, doi : 10.4230/LIPIcs.TIME.2023.4

[C5] **Beatrice Amico**, Carlo Combi: Supporting the Prediction of AKI Evolution Through Interval-Based Approximate Predictive Functional Dependencies, Artificial Intelligence in Medicin21st1th International Conference on Artificial Intelligence in Medicine, AIME 2023, Portoroz, Slovenia, June 12-15, 2023, doi: 10.1007/978-3-031-34344-5_40

[D1] **Beatrice Amico**, Explainable temporal data mining techniques to support the prediction task in Medicine, Doctoral Thesis, Ph.D. in Computer Science, University of Verona, 2023, https://www.di.univr.it/?ent=pubbdip&id=1093087

[BC2] **Beatrice Amico**, Carlo Combi, Yuval Shahar: Data Mining in Medicine, Machine Learning for Data Science Handbook: Data Mining and Knowledge Discovery Handbook. Cham: Springer International Publishing, 2023. 607-636, doi: 10.1007/978-3-031-24628-9_27.

2022

[J4] Carlo Combi, **Beatrice Amico**, Riccardo Bellazzi, Andreas Holzinger, Jason H Moore, Marinka Zitnik, John H Holmes: A manifesto on explainability for artificial intelligence in medicine, Artificial Intelligence in Medicine, vol. 133, 2022 doi: 10.1016/j.artmed.2022.102423, SJR 2023 Quartile: Artificial Intelligence Q1

[C6] **Beatrice Amico**, Carlo Combi: A 3-Window Framework for the Discovery and Interpretation of Predictive Temporal Functional Dependencies, Artificial Intelligence in Medicine: 20th International Conference on Artificial Intelligence in Medicine, AIME 2022, Halifax, NS, Canada, June 14-17, 2022, doi: 10.1007/978-3-031-09342-5_29

2021

[C7] Isabela A Chiorean, **Beatrice Amico**, Carlo Combi, John H Holmes: A Reproducible ETL Approach for Window-based Prediction of Acute Kidney Injury in Critical Care Unit and Some Preliminary Results with Support Vector Machines, IEEE International Conference on Bioinformatics and Biomedicine, BIBM 2021, Houston, TX, USA, December 9-12, 2021 (Virtual), doi: 10.1109/BIBM52615.2021.9669143

[C8] Matteo Mantovani, **Beatrice Amico**, Carlo Combi: Discovering predictive trend-event patterns in temporal clinical data. 36th Annual ACM Symposium on Applied Computing, SAC 2021, Gwangju, South Korea, March 22-March 26, 2021 (Virtual), doi:10.1145/3412841.3441937

2020

[J5] Arianna Dagliati, Darren Plant, Nisha Nisha, Meghna Jani, **Beatrice Amico**, Niels Peek, Ann W. Morgan, John Isaacs, Anthony Wilson, Kimme L. Hyrich, Nophar Geifman, Ann Barton; BRAGGSS Study Group: Latent Class Trajectory Modeling of 2-Component Disease Activity Score in 28 Joints Identifies Multiple Rheumatoid Arthritis Phenotypes of Response to Biologic Disease-Modifying Antirheumatic Drugs, Arthritis & rheumatology (Hoboken, N.J.) vol. 72,10 (2020): 1632-1642. doi:10.1002/art.41379, SJR 2023 Quartiles: Immunology Q1, Rheumatology Q1, Immunology and Allergy Q1

2019

[C9] **Beatrice Amico**, Arianna Dagliati , Darren Plant, Ann Barton, Niels Peek, Nophar Geifman. A Dashboard for Latent Class Trajectory Modelling: Application in Rheumatoid Arthritis, MEDINFO 2019: HEALTH AND WELLBEING E-NETWORKS FOR ALL, Lyon, France, 25-30 August, 2019, Vol.264, pp.911-915, doi:10.3233/SHTI190356

La sottoscritta Beatrice Amico dichiara in merito al presente curriculum vitae et studiorum che “tutto quanto in esso dichiarato corrisponde a verità ai sensi degli articoli 46 e 47 del D.P.R. 445/2000 e successive modificazioni e integrazioni”.

Verona, 05/10/2026

Beatrice Amico