Manuel Striani

Personal Data

Born in Alessandria (AL), Italy
Lives in Alessandria (AL), Italy

Bio and education

Manuel Striani is currently a temporary research fellow (SSD: INFO-01/A) at the Department of Sciences and Technological Innovation (DiSIT) of the University of Eastern Piedmont. His main research interests focus on artificial intelligence in healthcare and, in particular business process management, process mining in healthcare, knowledge abstraction and formalization through ontologies, hematological clinical trials on multiple myeloma, medical informatics, deep/machine learning algorithms, human-computer interaction and multicriteria data structures for compression and optimization algorithms.

He has obtained his PhD at the University of Turin - Science and High Technology (spec. Computer Science), Computer Science Department - on the 11th of February 2019 with a thesis entitled "A Knowledge-based abstraction framework for trace comparison and semantic process mining".

He has obtained his master's degree (summa cum laude) at the Department of Sciences and Technological Innovation (DiSIT) of the University of Eastern Piedmont in Alessandria on the 21st of October 2015.

Since February 2016, he is a member of the SIBIM (Società Scientifica Italiana di Informatica BioMedica, https://www.sibim.it/) and since September 2018 he is a member of AIxIA (Associazione Italiana per l'Intelligenza Artificiale, https://aixia.it/).

Links

Personal web page: https://upobook.uniupo.it/manuel.striani
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University career

2023 - now	Temporary Research Fellow (RTD-A – INFO-01/A), University of Eastern Piedmont (DiSIT)
2021 - 2023	Post-doc Research Fellow, University of Turin - Computer Science Department
2019 - 2021	Post-doc Research Fellow, University of Eastern Piedmont and SNS of Pisa
2015 - 2019	Ph.D. Student, University of Turin - Computer Science Department

Scientific positions

2024 - now	Member of the Editorial Board of BMC Medical Informatics and Decision Making (part of Springer Nature)
2023 - now	Guest Editor of SI – Artificial Intelligence and Decision Support Systems
2022 - 2024	Guest Editor of SI – JOCCH Journal on Computing and Cultural Heritage

MAIN FIELDS OF INTEREST

1. Artificial Intelligence
2. Medical Informatics
3. Knowledge Representation
4. Case-Based Reasoning
5. Decision Support System
6. Semantic Process Mining
7. Computational Ontologies
8. Multicriteria data structure and compression algorithms
9. Human-Computer Interaction (HCI)

CURRENT ISSUES OF RESEARCH

1. Multicriteria data structure

A multicriteria data structure, for a given problem $\boldsymbol{P}$, is defined by a pair $< \boldsymbol{\mathcal{F}}, \boldsymbol{A} >_{\boldsymbol{P}}$ consists of a set $\boldsymbol{\mathcal{F}}$ of data structures, each one solving $\boldsymbol{P}$ with a proper trade-off in the use of some computational resources, and a properly designed optimization algorithm that is able to efficiently select in $\boldsymbol{\mathcal{F}}$ the data structure that "best fits" an instance of $\boldsymbol{P}$ given in input. Recently I have been working on the use of data compression to speed-up machine learning algorithms. The rationale is that the implementation of many machine learning algorithms often boils down to repeated matrix vector multiplications involving very large matrices with strong regularities that makes them highly compressible. The aim of the research is to exploit compressibility to reduce not only the storage but also the number of arithmetic operations.

2. Mining, retrieval, analysis of business process for the improvement of health care

We propose the adoption of process mining techniques to learn process models from business process traces; the definition of proper similarity metrics for traces and business process models; the exploitation of these metrics within proper retrieval and ordering algorithms to support process analysis; testing will take place in real world domains (e.g. stroke management) optimization of process task scheduling in a cloud computing environment). Application of process mining techniques to process logs created from the information services of hospitals, to extract the process model by which patients with specific conditions (e.g. stroke patients, pre-term born babies or accident victims) are treated. This allows to understand what is really done in the structure, in order to compare this model with the procedures that are expected to be performed by the staff. This comparison highlights the differences that can help understanding why the expected procedures are not properly managed, obtaining useful information for the optimization and improvement of the care process.

3. Towards a Knowledge-Intensive and Technology-enhanced Patient Emergency Management

Patients in emergency (e.g. stroke patients, pre-term born babies or accident victims) are normally taken to the closets hospital structure, which might be insufficiently equipped, in terms of human or instrumental resources, to address their needs. In these situations, the stabilization process may be suboptimal because patients has to be stabilized, and then carried to a larger and more suitable health care center, where specialized physicians and all necessary diagnostic/therapeutic devices are available. During transportation to a larger center by ambulance, their parameters are monitored, but the time series are not recorded and not accessible in real time. We propose tools and methodologies to overcome these issues. The work will advance research in process mining, Case-Based Reasoning, time series retrieval.

4. Database management systems for supporting Biomedical research

Clinical and research data are essential for patient care, research and healthcare system planning, requires a robust and secure manner in which to collect, store, transfer and analyze data. Researchers require environment specific data management tools in order to undertake accurate, safe and secure data curatorship. An independent researcher may not have access to formal informatics and data management resources. In particular, health-care researchers often have limited information technology and computer skills. Emergent researchers find this to be another constraint in carrying out research. Data quality is improved by enabling data collection by a diverse team. REDCap^{TM} is a software tool developed at the Centre for Clinical and Translational Research at VanderbiltUniversity in Nashville, Tennessee, USA. REDCap provides researchers with a tool for design eCRFs(electronic Clinical Report Form) and the development of electronic data capture tools for clinical trials.REDCap allows the researcher to choose and define their data elements in compliance with the clinical protocol. Although this may limit interoperability, it is a consequence of the user-defined metadata model. The Faculty of Health Sciences has recognized the need to support information technology for the formalization of knowledge domains and workflows regarding clinical protocols.

5. Process mining and information retrieval on process logs and time series

In many application areas, the processes being executed and the temporal evolutions of data are recorded, in the form of (process) logs or time series. In such a context, there are main topics: the retrieval of series (or process traces), and the mining of process models from the logs. In both such contexts. Current research activity is on the development of techniques to operate at multiple level of abstractions and to achieve efficiency through the identification and use of proper indexing structures.

6. Development of computational ontologies for decision support

In the development of decision support systems, special attention is paid to the development of ontologies that allow the representation and reasoning on the caused effects of actions taken during a process (manufacturing, clinical or other). We define these ontologies through three main classes: State, Action and EffectAction. The States are abstractions obtained from the data generated by the process. These states are categorized into initial states (initial states of the process),goal states (states desired final or otherwise) and intermediate process states. Starting with an initial(or a current) state, it is possible to reach a goal, following the recommended actions formalized through classes of type Action. Relations have been introduced to relate these entities (like for example, the Effect-Action relation), which realizes the link between actions and their effect (one State caused by the actions themselves).

7. Case Based Reasoning, time series and temporal abstractions

In many contexts where CBR is a valid technique for the retrieval of similar cases, the problem of the treatment of time series arises. In this field, our research focuses on efficient retrieval of similar time series, through dimensionality reduction techniques that allow the calculation of the distance of few representative points instead of all the points of the time series. Furthermore, the introduction of Spatial Indexing trees optimizes even more the retrieval performance. Moreover, the transformation of those features in the form of abstractions of trend and states allows the efficient recovery of cases, thanks to a new multi-dimensional indexing structure providing flexible queries. This structure takes into account different levels of temporal granularity and different taxonomic levels of the language that describing trends and states.

TOP PAPERS

1. Bottrighi, A., Guazzone, M., Leonardi, G., Montani, S., Striani, M., & Terenziani, P. (2023). *Towards Action-State Process Model Discovery*. Data, 8(8), 130. https://doi.org/10.3390/DATA8080130

2. Lieto, A., Striani, M., Gena, C., Dolza, E., Marras, A. M., Pozzato, G. L., & Damiano, R. (2023). *A sensemaking system for grouping and suggesting stories from multiple affective viewpoints in museums*. CoRR, abs/2304.14117. https://doi.org/10.48550/ARXIV.2304.14117

3. Ferragina, P., Manzini, G., Gagie, T., Köppl, D., Navarro, G., Striani, M., & Tosoni, F. (2022). *Improving Matrix-vector Multiplication via Lossless Grammar-Compressed Matrices*. Proc. VLDB Endow., 15(10), 2175–2187. https://doi.org/10.14778/3547305.3547321

4. Leonardi, G., Montani, S., & Striani, M. (2022). *Explainable process trace classification: An application to stroke*. J. Biomed. Informatics, 126, 103981. https://doi.org/10.1016/J.JBI.2021.103981

5. Leonardi, G., Striani, M., Quaglini, S., Cavallini, A., & Montani, S. (2018). *Leveraging semantic labels for multi-level abstraction in medical process mining and trace comparison*. J. Biomed. Informatics, 83, 10–24. https://doi.org/10.1016/J.JBI.2018.05.012

6. Montani, S., Leonardi, G., Striani, M., Quaglini, S., & Cavallini, A. (2017). *Multi-level abstraction for trace comparison and process discovery*. Expert Syst. Appl., 81, 398–409. https://doi.org/10.1016/J.ESWA.2017.03.063