

# COMPUTATIONAL INTELLIGENCE FOR DIGITAL HEALTH: A BRIEF SUMMARY OF OUR RESEARCH WORK

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## Abstract

In the last few decades, a digitization process has involved various aspects of daily life, and the healthcare sector is one of the fields most heavily affected by this digital transformation. Artificial Intelligence, and in particular Computational Intelligence (CI) techniques, such as Neural Networks and Fuzzy Systems, have proven to be promising methods for extracting meaningful knowledge from medical data and for developing intelligent systems for faster diagnosis, improved monitoring and effective healthcare. CI-based systems can learn models from data that evolve as data changes, taking into account the uncertainty that characterizes health data and processes. Our group working at the Computational Intelligence Laboratory (CILab) of the Department of Computer Science, University of Bari, is currently carrying out scientific research on the application of CI techniques to Digital Health problems.

One activity concerns the creation of predictive models to support the early detection of episodes of Bipolar Disorder, a chronic mental illness characterized by the change of episodes that include healthy state, depression and mania or mixed states. We are investigating the effectiveness of applying semi-supervised learning to real-world data collected at the Department of Affective Disorders, Institute of Psychiatry and Neurology in Warsaw (Poland), through the interaction of patients with smartphones [1]. Another activity concerns the development of a monitoring system for the estimation of vital parameters based on the analysis of facial video frames [2]. The proposed system is based on a contact-less device (a videocamera integrated in a mirror), which is coupled with an intelligent module based on fuzzy logic rules to predict the level of risk of cardiovascular diseases. In collaboration with the local Institute for Biomedical Technologies of the Italian National Research Council, we are also working on the analysis of microRNA data from pediatric patients with Multiple Sclerosis [3]. This is a rare disease, the underlying mechanisms of which are still unknown. We want to support biology experts by not only providing some automated diagnostic tools, but also helping them find undiscovered patterns in the data.

## References

- [1] Casalino, G., Castellano, G., Galetta, F., Kaczmarek-Majer, K.: Dynamic incremental semi-supervised fuzzy c-means for bipolar disorder episode prediction. In: Discovery Science, 23rd International Conference, DS 2020, Thessaloniki, Greece, October 19–21, 2020, Proceedings, LNAI, vol. 12323, pp. 79–93. Springer (2020)
- [2] Casalino, G., Castellano, G., Pasquadibisceglie, V., Zaza, G.: Contact-less real-time monitoring of cardiovascular risk using video imaging and fuzzy inference rules. *Information* **10**(1) (2019)
- [3] Casalino, G., Vessio, G., Consiglio, A.: Evaluation of cognitive impairment in pediatric multiple sclerosis with machine learning: An exploratory study of miRNA expressions. In: 2020 IEEE Conference on Evolving and Adaptive Intelligent Systems (EAIS). pp. 1–6. IEEE (2020)