

## Emotion recognition using non-invasive biometrics

### Teacher(s)

Prof. Nicole Novielli - University of Bari Course duration: 16 hours (2 CFU)

<http://collab.di.uniba.it/nicole/>

### Course website

MS Teams can be used for online lectures, if needed. Please, contact the course professor to obtain the code to access the team.

### Course description (min 150, max 300 words)

Research on affective computing investigates emotion recognition and simulation since decades. Indeed, emotions are a fundamental component of our everyday life: they influence our cognitive skills, influence the outcome of activities requiring creativity and problem-solving skills, and contribute to the success of communication and collaborative activities.

Early recognition of negative emotions, such as stress, frustration, and anger can enable just-in-time corrective actions in many application fields, including wellbeing of knowledge workers, assistive technologies, computer-mediated communication, human-computer interaction, and so on. Thus, we envision the emergence and adoption of tools for enhancing emotion awareness during software development.

In this study, we will focus on the problem of reliable identification of the emotions using non-invasive biometrics. We will survey the state-of-the-art in biometric-based emotion recognition, with particular focus on the use of non-invasive sensors and examines to what extent they are able to detect affective expressions when used by individuals during their daily activities. A discussion is offered about the advantages and limitations of relying on self-reported, self-assessed emotions as gold standard and on the open challenges due to differences between individuals, towards the development and deployment of reliable sensor-based emotion classifiers for real use scenarios. Finally, we will discuss recent advances in applied research that leverage biometric-based emotion recognition for supporting emotion awareness in computer-supported cooperative work, with specific focus on the emotions experienced by developers engaged in collaborative software development tasks.

The course will feature both lectures and practical sessions. The latter, in particular, will show how to process the raw signal obtained by biometric sensors in order to extract features to be used for training emotion classifiers based on supervised machine learning.

### Course Syllabus

1. Background and Theoretical models of emotions
  - a. What is emotion recognition? Fundamentals and background
  - b. Theoretical background on affect modeling and operationalization of emotions
2. Biometrics for emotion recognition
  - a. Which data source? EEG, EDA, Heart-related metrics o Emotion recognition based on facial expressions
  - b. Voice analysis
3. Sensor-based emotion detection in practice
  - a. State-of-the-art devices
  - b. Preprocessing of raw signal and feature extraction
  - c. Training and evaluating emotion classifiers using biometrics

4. Sensor-based emotion detection in computer-supported cooperative work: applications, opportunities, and open challenges

**Course period**

Feb-April 2026 (II semester, a.a. 2025-26)

**SSD  
INF/01****Credits and Hours**

2 credits lectures (16 hours).

**Exam Modality**

Paper presentation. Students present the content of one papers selected among a pool of papers suggested by the teacher. No groups are allowed.

**Teacher CV**

Nicole Novielli is an Associate Professor at the University of Bari, Italy. Her expertise is in Affective Computing. She received the PhD in Computer Science from the University of Bari (Italy) in 2010. During. Since 2006, her research is on human factors and emotions in natural language interaction. She is a member of the COLLAB research group, whose research is in Software Engineering and Computer-Supported Cooperative Work, with a focus on collaborative software development.

For more info, please visit: <http://collab.di.uniba.it/nicole/>

**Teacher Main Publications**

1. Daniela Girardi, Filippo Lanubile, Nicole Novielli, Alexander Serebrenik, "[Emotions and Perceived Productivity of Software Developers at the Workplace](#)", *IEEE Transactions on Software Engineering*, 2021 (online), DOI: [10.1109/TSE.2021.3087906](https://doi.org/10.1109/TSE.2021.3087906)
2. D. Girardi, N.Novielli, D. Fucci, F. Lanubile. "[Recognizing Developers' Emotions while Programming](#)". In *Proceedings of the 42th International Conference on Software Engineering (ICSE 2020)* October, 2020 – DOI: <https://doi.org/10.1145/3377811.3380374>
3. Gennaro Laudato, Simone Scalabrino, Nicole Novielli, Filippo Lanubile, Rocco Oliveto. "[Predicting Bugs by Monitoring Developers During Task Execution](#)". In *Proceedings of the 45th International Conference on Software Engineering (ICSE 2023)* , DOI: [10.1109/ICSE48619.2023.00100](https://doi.org/10.1109/ICSE48619.2023.00100)
4. F. Calefato, F. Lanubile, F. Maiorano, N. Novielli, "[Sentiment Polarity Detection for Software Development](#)". *Empirical Software Engineering* (2018) DOI: <https://doi.org/10.1007/s10664-017-9546-9>.
5. Nathan Cassee, Fiorella Zampetti, Nicole Novielli, Alexander Serebrenik, Massimiliano Di Penta, "[Self-Admitted Technical Debt and comments' polarity: an empirical study](#)", *Empirical Software Engineering*, 2022 (online), DOI: [10.1007/s10664-022-10183-w](https://doi.org/10.1007/s10664-022-10183-w)
6. Nicole Novielli, Fabio Calefato, Filippo Lanubile, Alexander Serebrenik, "[Assessment of Off-the-Shelf SE-specific Sentiment Analysis Tools: An Extended Replication Study](#)". *Empirical Software Engineering*, 2021, DOI: [10.1007/s10664-021-09960-w](https://doi.org/10.1007/s10664-021-09960-w)
7. N. Novielli, C. Strapparava. "[The Role of Affect Analysis in Dialogue Act Identification](#)". *IEEE Transactions on Affective Computing*, vol. 4, no. 4, pp. 439-451, Oct.-Dec. 2013
8. Bin Lin, Nathan Cassee, Alexander Serebrenik, Gabriele Bavota, Nicole Novielli, Michele Lanza "[Opinion Mining for Software Development: A Systematic Literature Review](#)". *ACM Transactions on Software Engineering and Methodology*, 2022, DOI: [10.1145/3490388](https://doi.org/10.1145/3490388)

9. Felipe Ebert, Fernando Castor, Nicole Novielli, Alexander Serebrenik, "[An Exploratory Study on Confusion in Code Reviews](#)". *Empirical Software Engineering*, Vol. 26, Issue 12, 2021, DOI: 10.1007/s10664-020-09909-5
10. V. Basile, N. Novielli, D. Croce, F. Barbieri, M. Nissim, V. Patti, "[Sentiment Polarity Classification at EVALITA: Lessons Learned and Open Challenges](#)". *IEEE Transactions on Affective Computing* (online Nov. 2018). DOI: 10.1109/TAFFC.2018.2884015