

Course proposal

Emotion recognition using non-invasive biometrics

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

Course description

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

- Background and Theoretical models of emotions
 - What is emotion recognition? Fundamentals and background
 - Theoretical background on affect modeling and operationalization of emotions
- Biometrics for emotion recognition
 - Which data source? EEG, EDA, Heart-related metrics
 - Emotion recognition based on facial expressions
 - Voice analysis
- Sensor-based emotion detection in practice
 - State-of-the-art devices
 - Preprocessing of raw signal and feature extraction
 - Training and evaluating emotion classifiers using biometrics
- Sensor-based emotion detection in computer-supported cooperative work: applications, opportunities, and open challenges

Course period

Feb-April 2024

SSD

INF/01

Credits and Hours

16 hours (2 CFU)

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, Associate Professor: <http://collab.di.uniba.it/nicole/>

Teacher(s) 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. Valentina Piantadosi, Simone Scalabrino, Alexander Serebrenik, Nicole Novielli, Rocco Oliveto "[Do Attention and Memory Explain the Performance of Software Developers?](#)", *Empirical Software Engineering* (accepted: 2023)
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)*
4. 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>
5. D. Girardi, A. Ferrari, N. Novielli, P. Spoletini, D. Fucci, T. Huichapa. "[The Way it Makes you Feel. Predicting Users' Engagement during Interviews with Biofeedback and Supervised Learning](#)". In *Proceedings of the 28th International Requirements Engineering Conference (RE'20)*, August 31 – September 4, 2020 – DOI: [10.1109/RE48521.2020.00016](https://doi.org/10.1109/RE48521.2020.00016)
6. 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)
7. Hideaki Hata, Nicole Novielli, Sebastian Balthes, Raula Gaikovina Kula, Christoph Treude, "[GitHub Discussions: An Exploratory Study of Early Adoption](#)", *Empirical Software Engineering*, 2021 (online), DOI: [10.1007/s10664-021-10058-6](https://doi.org/10.1007/s10664-021-10058-6)
8. 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>.
9. D. Girardi, A. Ferrari, N. Novielli, P. Spoletini, D. Fucci, T. Huichapa. "[The Way it Makes you Feel. Predicting Users' Engagement during Interviews with Biofeedback and Supervised Learning](#)". In *Proceedings of the 28th International Requirements Engineering Conference (RE'20)*, August 31 – September 4, 2020 – DOI: [10.1109/RE48521.2020.00016](https://doi.org/10.1109/RE48521.2020.00016)

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10.1109/RE48521.2020.00016

10. F. Calefato, F. Lanubile, N. Novielli, "[How to Ask for Technical Help? Evidence-based Guidelines for Writing Questions on Stack Overflow](#)". *Information and Software Technology*, Volume 94, February 2018, pp. 186-207. DOI:
<https://dl.acm.org/doi/abs/10.5555/3163583.3163673>