Digital Phenotyping and Smart Sensing

Outline

Digitisation is currently not only determining our social discourse, but also finds its equivalent in various scientific fields. In the context of psychological and behavioural medicine research, smart device technologies offer a variety of new research opportunities. Our digital traces that we leave behind every day make it possible to digitally follow peoples´ everyday lives on a longitudinal level. The smartphone is the most frequently used source for digital traces, but also a variety of other "smart" devices enable research possibilities based e.g. on speech, voice and face recognition data, digital text analysis, biosensor technologies and complex smart home usage evaluations. Human interaction leaves behind increasingly extensive digital traces in all these Internet-connected devices, which can be used scientifically to map and predict bio-psycho-social aspects of human behaviour, ranging from personality to clinical states and courses of physical and mental health.

The use of these data to predict human experience and behaviour is described by the term digital phenotyping, as an extension of the concept of genetic phenotypes, i.e. a set of all characteristics of the organism in question. In an interdisciplinary network consisting of colleagues from the fields of psychology, computer science, engineering, medicine, biology and data science, the department of Clinical Psychology and Psychotherpy at Ulm University is dedicated to the basic scientific and applied research of the possibilities, but also the challenges and limits of using digital traces to phenotype human behaviour. Research objectives are in particular the development and AI-based continuous optimization

1) of predictive models on the development and course of mental disorders and somatic diseases,

2) of predictive models on the course of treatment, combined with decision-aid systems for early treatment plan interventions in the case of undesired treatment courses

3) personalised "just-in-time" interventions derived from the previously described prediction models.

Project Team

Prof. Dr. Harald Baumeister, Eva-Maria Messner, Robin Kraft, Yannik Terhorst, u.v.m.

Collaborating Partners

- Prof. Dr. Schuller, Universities Augsburg/London
- Prof. Dr. Pryss, University Würzburg
- Prof. Dr. Montag, Ulm University
- Research Network Smart Sensing Systems, Ulm University
- Centre of Competence Large Scale Software Systems (LS3), Ulm University
- Centre of Competence Explainability, Fairness and Acceptability of Intelligent Systems (EFA), Ulm University
- …

Funding

Several specific own-funded and third party funded projects

Duration

Duration: 2017 – ongoing

Publications

Publications of the Department:
https://www.uni-ulm.de/en/in/psy-klips/publications/

Department of Clinical Psychology and Psychotherapy, Ulm University

Publications (selection)

- Montag, C., Sindermann, C., Baumeister, H. (2020). Digital phenotyping in psychological and medical sciences: a reflection about necessary prerequisites to reduce harm and increase benefits. Current Opinion in Psychology, 36, 19-24.
- Kraft, R., Schlee, W., Stach, M., Reichert, M., Langguth, B., Baumeister, H., Probst, T., Hannemann, R., Pryss, R. (2020). Combining mobile crowdsensing and ecological momentary assessments in the healthcare domain. *Frontiers in Neuroscience, 14,* 164.
- Schuller, B.W., Batliner, A., Bergler, C., Messner, E.M., Hamilton, A., Amiriparian, S., Baird, A., Rizos, G., Schmitt, M., Stappen, L., Baumeister, H., Deighton MacIntyre, A., Hantke, S. (2020). The INTERSPEECH 2020 Computational Paralinguistics Challenge: Elderly Emotion, Breathing & Masks. *Interspeech,* Shanghai, China.
- Baumeister, H., Montag, C. (Hrsg.). (2019). Digital Phenotyping and Mobile Sensing: New Developments in Psychoinformatics. Cham: Springer Nature.
- Baird, A., Amiriparian, S., Cummins, N., Sturmbauer, S., Janson, J., Messner, E.M., Baumeister, H., Rohleder, N., Schuller, B. (2019). Using speech to predict sequentially measured cortisol levels during a Trier Social Stress Test. *Interspeech 2019,* 1352.
- Brown, R.C., Bendig, E., Fischer, T., Goldwich, A.D., Baumeister, H., Plener, P.L. (2019). Can acute suicidality be predicted by Instagram data? Results from qualitative and quantitative language analyses. *PloS one, 14,* e0220623.
- Kraft, R., Birk, F., Reichert, M., Deshpande, A., Schlee, W., Langguth, B., Baumeister, H., Probst, T., Spiliopoulou, M., Pryss, R. (2019). Design and implementation of a scalable crowdsensing platform for geospatial data of tinnitus patients. *IEEE 32nd International Symposium on Computer-Based Medical Systems (CBMS),* 294-299.
- Messner, E.M., Sariyska, R., Mayer, B., Montag, C., Kannen, C., Schwerdtfeger, A., Baumeister, H. (2019). Insights–Future Implications of Passive Smartphone Sensing in the Therapeutic Context. *Verhaltenstherapie,* e501951.
- Montag, C., Baumeister, H., Kannen, C., Sariyska, R., Meßner, E.-M., Brand, M. (2019). Concept, Possibilities and Pilot-Testing of a New Smartphone Application for the Social and Life Sciences to Study Human Behavior Including Validation Data from Personality Psychology. *J, 2,* 102-115.
- Stappen, L., Cummins, N., Meßner, E.-M., Baumeister, H., Dineley, J., Schuller, B. (2019). Context Modelling using hierarchical attention networks for sentiment and self-assessed emotion detechtion in spoken narratives. *ICASSP 2019: Brighton, UK.*
- Rathner, E.-M., Terhorst, Y., Cummins, N., Schuller, B., Baumeister, H. (2018). State of mind: Classification through self-reported affect and word use in speech. *Interspeech: Hyderabad.*
- Rathner, E.M., Djamali, J., Terhorst, Y., Schuller, B., Cummins, N., Salamon, G., Hunger-Schoppe, C., Baumeister, H. (2018). How did you like 2017? Detection of language markers of depression and narcissism in personal narratives. *Interspeech:* Hyderabad.
- Sariyska, R., Rathner, E.-M., Baumeister, H., Montag, C. (2018). Feasibility of Linking Molecular Genetic Markers to Real-World Social Network Size Tracked on Smartphones. *Frontiers in Neuroscience, 12,* 945.