SensAI+Expanse
Adaptation on Human Behaviour Towards Emotional Valence Prediction

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Bio

Nuno A. C. Henriques
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PhD in Cognitive Science from ULisboa
MSc in Informatics Engineering from FCT/NOVA

Chief Artificial Intelligence Officer at MettaNoon
PropTech Start-up Advisor at Unlockit

Developing socially conscious opportunities to creatively apply Sensory AI and more. Thinking as a data and information architect, engineer, scientist, and strategist towards efficient innovation.

It all started with the ZX Spectrum 48k and never stopped from coding search engines, architecting information systems, engineering databases, Cloud, Web, and mobile development integrations. Further, on robotics software, GPS-based navigation, live video human face detection, and IoT (mobile) sensors' data acquisition. Bridging state-of-the-art algorithms and techniques towards automated machine learning, explainable, and efficient predictions in context regarding human emotions.
Inferring Emotion

“[…] constructions of the world, not reactions to it.”

“[…] created from concepts which are the predictions that give meaning to your affect in your environment.”

Lisa Feldman Barrett
Professor of Psychology at Northeastern University
https://cos.northeastern.edu/people/lisa-barrett/

Current research issues

- Debate regarding cross-cultural bias.
- Brain-body phenomena in context.
- Vary in dynamic ways over time.
Research Questions

How to build a predictive model?
- Emotional valence changes.
- Human context (sensors, text, self-report).
- Artificial agent in mobile device.

How to leverage such a model?
- Adapt interaction.
- Foster empathy.
- Non-anthropomorphic agent.
Emotion Sensor

A sensible approach
- Valence dimension (Circumplex model).
- Discrete 3-class scale (ground truth).
- Continuous scale (sentiment analysis).
- Spatial and temporal context add-ons.
Human-Agent Interaction

**Interaction** Non-invasive; non-animal-like; non-anthropomorphic; adaptive rhythms to save resources.

**Data** Mobile sensors; diary sentiment analysis; valence self-report.

**Context** Activity dashboard; geolocation; moment.

Interact daily, mood self-report

Activity stats, empathy score, emotional valence in context
SensAI+Expanse: Data, Flow, Adaptation

Adaptive Mechanisms

Application

Reconstruct
Resample
Align time
Geolocation
Clusters
Global grid
Wide align
Split train/test
Class balance
Auto adapt,
train cross val,
params, learn

Prediction model / estimator / person
Emotional valence in context

Sentiment analysis

N.A.C. Henriques (ULisboa)
Interaction

Empathy score

- Decays over time.
- Increases with self-reports.
Insights

- Sentiment self-reported.
- SensAI sentiment analysis (diary and Twitter texts).
- Expanse learning.
- Predictions in context.
Learning Task Requirements

**Features**  Geolocation (clusters and grid); hour of the day; quarter of the day; day of the week.

**Estimators**  3 model classes + 1 baseline per person.

**Models**  Adapted and fine-tuned to each person.

**Predictions**  Past data predicts future emotional valence in context.
**Learning**

Model prediction performance on entities

F1 score

Dummy (strategy=stratified) as baseline

Estimator

- Dummy
- Logistic Regression
- Extreme Gradient Boosting
- TensorFlow Keras MLP

Entity (eligible population=31)

Score
Prediction

Entities prediction performance
F1 score
Extreme Gradient Boosting

- Good prediction performance in most cases.
- Efficient energy use
  - $\frac{1}{10}$ duration vs. MLP.
  - Best $F_1 = 0.91$.
- Per class probability.
- Explainable.
Summary

- Mobile sensing agent with adaptation and learning capabilities towards emotional valence predictions in context.
- Age range and gender neutral.
- Robust to idiosyncratic factors.
- Potentially free of known bias\textsuperscript{1}.
- Open source code and open science.

\textsuperscript{1}Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? \textit{Behavioral and Brain Sciences}, 33(2-3), 61–83. https://doi.org/10.1017/S0140525X0999152X
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