SensAI+Expanse
Adaptation on Human Behaviour Towards Emotional Valence Prediction

Nuno A. C. Henriques
BioISI
Ciências/ULisboa
Portugal
nach@edu.ulisboa.pt

Helder Coelho
BioISI
Ciências/ULisboa
Portugal
hcoelho@di.fc.ul.pt

Leonel Garcia-Marques
CICPSI
Psicologia/ULisboa
Portugal
garcia_marques@sapo.pt

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Bio

Nuno A. C. Henriques
https://nunoachenriques.net/

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

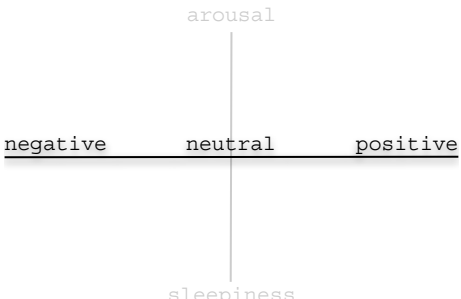
How to build a predictive model?

- 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.

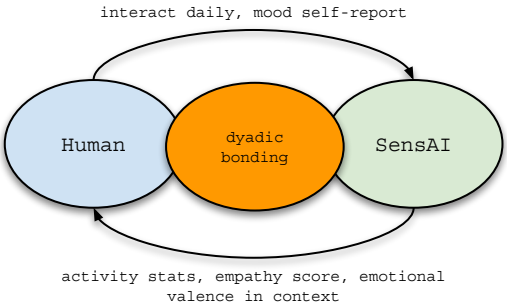
Emotion Sensor



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

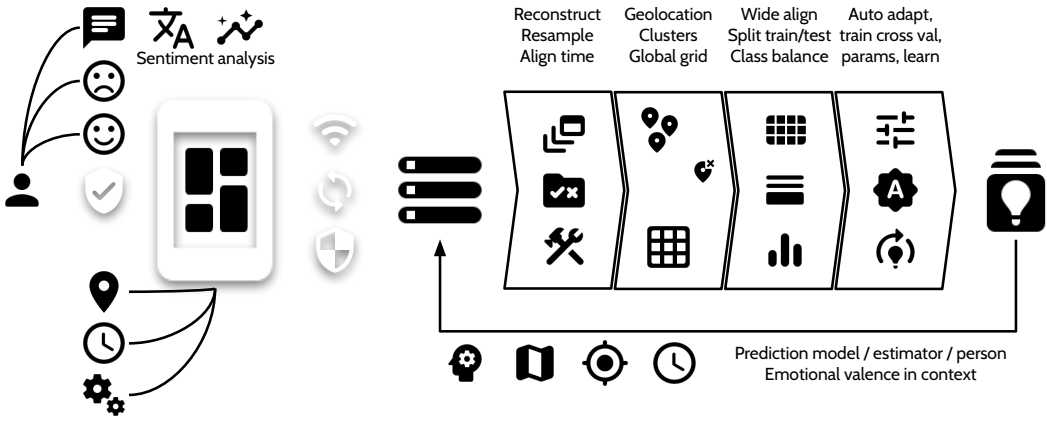


Interaction Non-invasive; non-animal-like; non-anthropomorphic; adaptive rhythms to save resources.

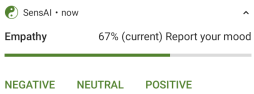
Data Mobile sensors; diary sentiment analysis; valence self-report.

Context Activity dashboard; geolocation; moment.

SensAI+Expanse: Data, Flow, Adaptation

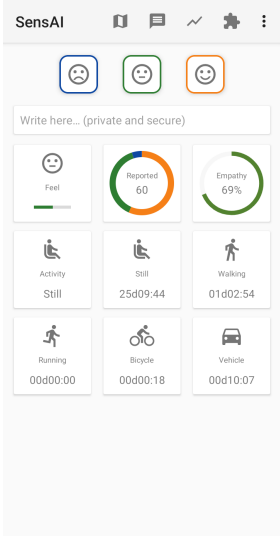


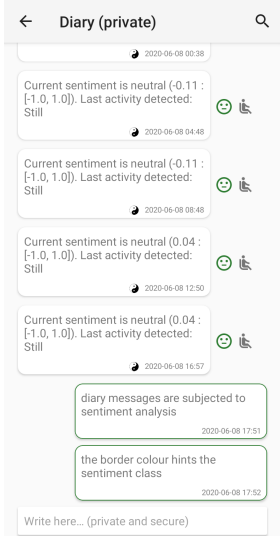
Interaction



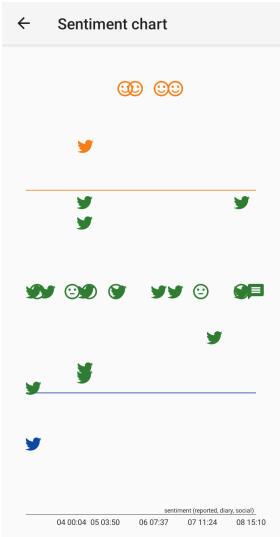
Empathy score

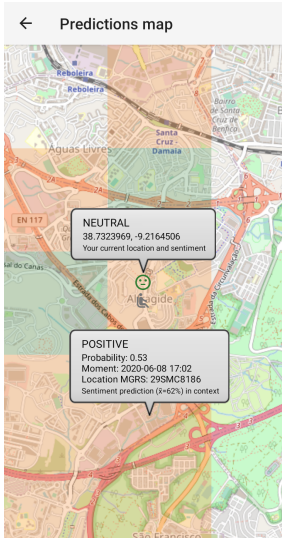
- Decays over time.
- Increases with self-reports.





Insights



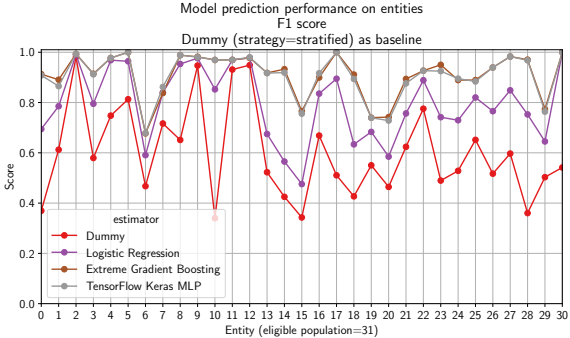


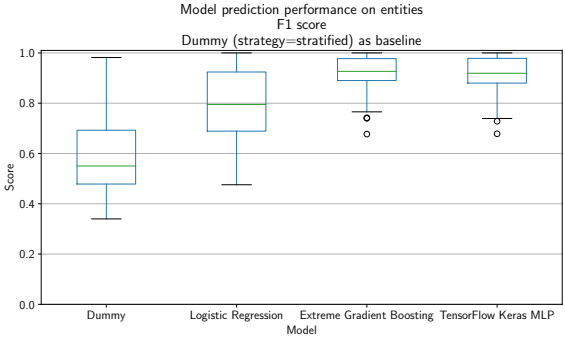
- Sentiment self-reported.
- SensAI sentiment analysis (diary and Twitter texts).
- Expanse learning.
- Predictions in context.

Learning Task Requirements

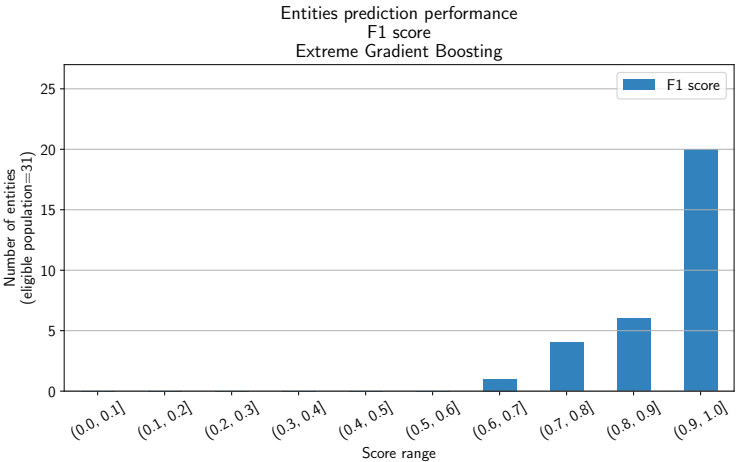
Features	Geolocation (clusters and grid); hour of the day; quarter of the day; day of the week.
Estimators	3 model classes + 1 baseline per person.
Models	Adapted and fine-tuned to each person.
Predictions	Past data predicts future emotional valence in context.

Learning


Model prediction performance on entities
F1 score
Dummy (strategy=stratified) as baseline
Score
Entity (eligible population=31)
estimator
Dummy
Logistic Regression
Extreme Gradient Boosting
TensorFlow Keras MLP


Model prediction performance on entities
F1 score
Dummy (strategy=stratified) as baseline
Score
Dummy
Logistic Regression
Extreme Gradient Boosting
TensorFlow Keras MLP
Model

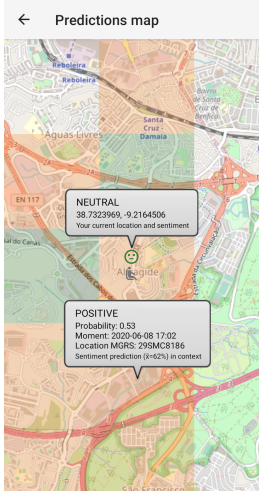
Prediction



- Good prediction performance in most cases.
- Efficient energy use
  - $1/10$ duration vs. MLP.
  - Best $\overline{F1} = 0.91$.
- 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[1].
- Open source code and open science.



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

Thanks

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