SensAI+Expanse Emotional Valence Prediction Studies with Cognition and Memory Integration

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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.

Emotions and Human-Agent Interaction

*"[...] if we want **computers** to be genuinely intelligent*
*and to **interact naturally with us**, we must give computers*
*the ability to **recognize**, understand,*
*even to have and express **emotions** [...]"*[1]

[1] Picard, R. W. (1997). *Affective Computing*. MIT Press.

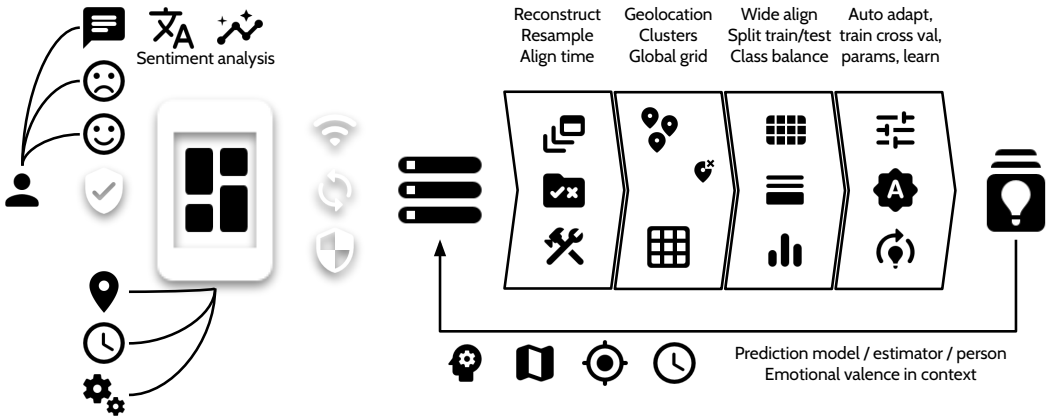
Research Problem

Behaviour Is modified by affective states.

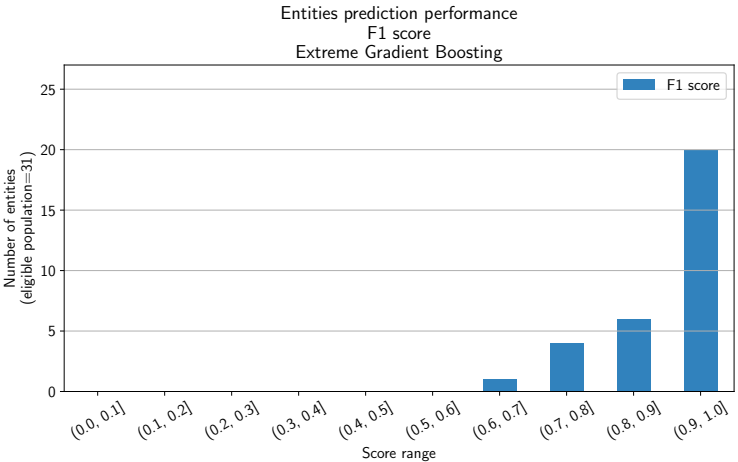
Interaction May be subject to change or bias.

Prediction When, where, and more context may improve the dyadic bonding.

Architecture, Data, Flow: SensAI+Expanse



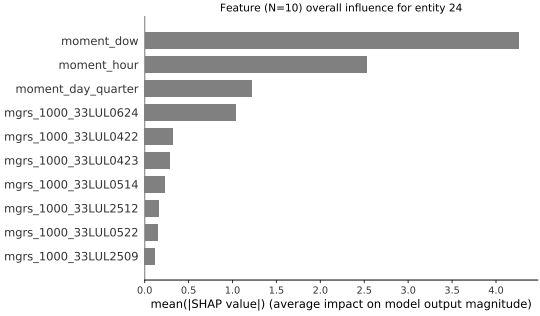
Best Model on Average[2]

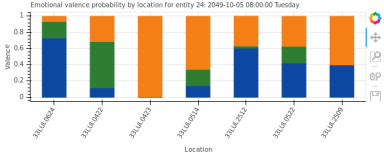


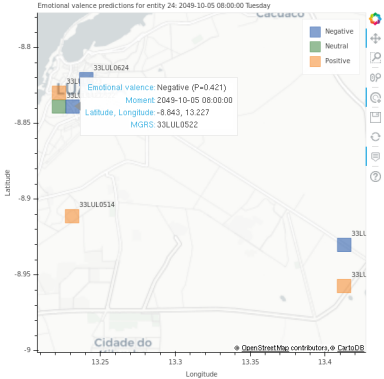
- Prediction performed well in most cases.
- Efficient energy use vs. Multi-Layer Perceptron
  - $^1/_{10}$ duration.
  - Best $\overline{F1} = 0.91$.
- Per class probability.
- Explainable.
- Each person provides a distinct data set.

[2] Henriques, N. A. C., Coelho, H., & Garcia-Marques, L. (2019). SensAI+Expanse Adaptation on Human Behaviour Towards Emotional Valence Prediction. 1–6. http://arxiv.org/abs/1912.10084v4

3-Class Probabilistic Prediction: Example for Entity 24





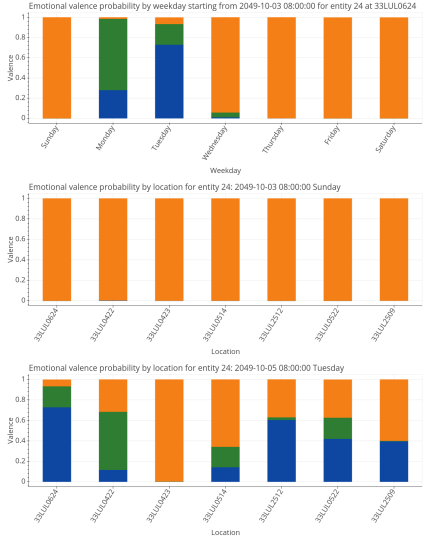


- Evidence of time-related feature impact.
- Location competing with time in some cases.

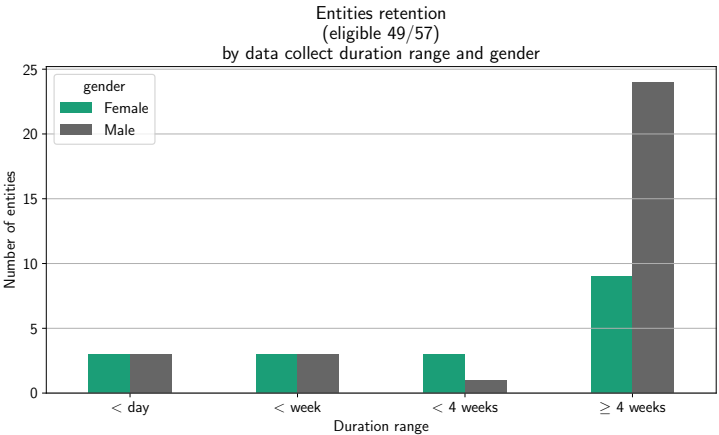
Time and Space Competing Features: Results

- Overall temporal dimension sensitivity.
- Most influential (prediction model):
  - Weekday: 64.5%
  - Hour: 25.8%
  - Location: 9.7%
- Prediction of idiosyncratic factors.
- Emotional valence changes in context.
- Adding new features may reveal other relevant factors (e.g., sports).

Hand-picked sample: Entity 24

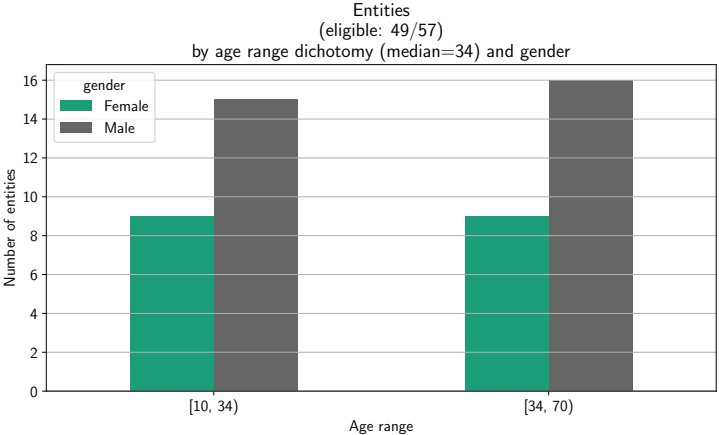


Participants



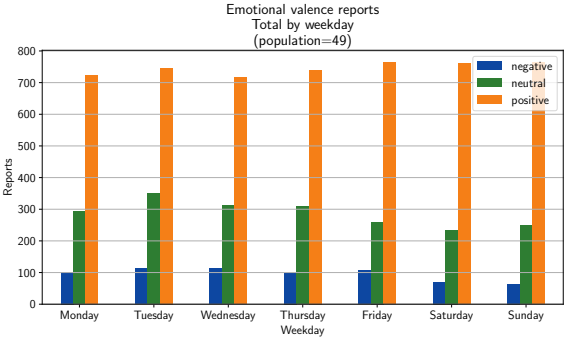
- Age [10, 70), median 34.
- Females and males.
- 33 retained ($\geq$ 4 weeks).
- Africa, America, Asia, Europe.

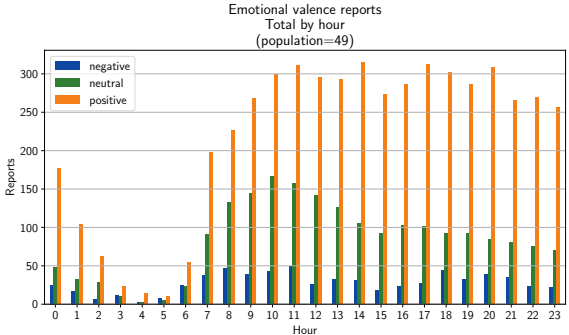
Design, Procedure, and Demographics



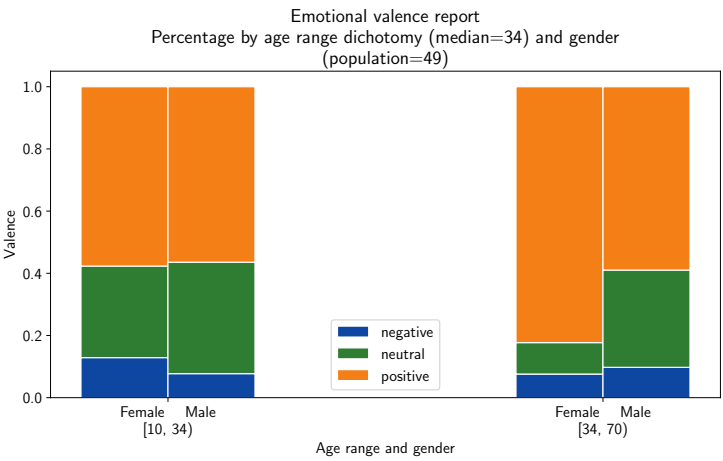
- Worldwide access using a free Android app.
- Neutral messages (age, gender).
- Chromatically consistent. Negative | Neutral | Positive
- Sensorial and non-invasive artificial agent.

Behaviour Aggregated





Behaviour Differences



$[10, 34)$ **vs.** $[34, 70)$
Evidence of differences.
$p = 1.161 \times 10^{-30}$

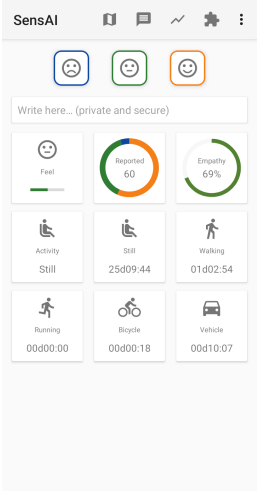
$[10, 34)$ **F. vs.** $[34, 70)$ **F.**
Older group less negative.
$p = 5.539 \times 10^{-14}$

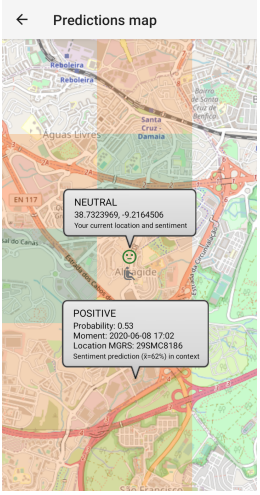
$[34, 70)$ **F. vs.** $[34, 70)$ **M.**
Female more positive.
$p = 7.027 \times 10^{-67}$

Mann-Whitney U, $\alpha = 0.05$

Summary

- A novel system for studies regarding emotional valence changes in context.
- Mobile sensing agent with adaptation and learning capabilities.
- Age range and gender neutral.
- Robust to idiosyncratic factors.
- Potentially free of known bias[3].
- Open source code and open science.





[3] 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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