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Reviewing Facial Expression Recognition Rate

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INTRODUÇÃO

As per the work plan titled **Machine Learning Tools Applied to Human Robot Interaction** candidate carried out scheduled steps. Human-Robot Interaction (HRI) involves the study of humans, robots, and the ways they influence each other. As emotion is a key factor in human relationships and social interactions, it is also imperative for interaction between humans and robots. Various psychological studies have shown social navigation (motion) has strong correlation with emotion and personal space (Kivrak et al., 2020). Emotion-aware navigation strategies generate proxemic constraints based on human emotion. Thus, the research theme is defined as *Recognize emotions from facial expressions during the social navigation of robot.* This work is associated with the project ROSANA (Paiva et al., 2020).
To explore exercised techniques and available resources a quasi-systematic review was carried out. Important observations and findings are presented here.

OBJETIVO

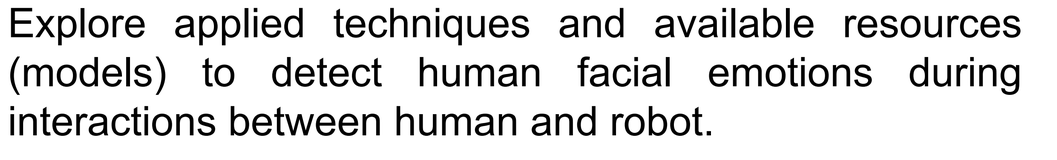
Explore applied techniques and available resources (models) to detect human facial emotions during interactions between human and robot.

MÉTODOS

With the interest in facial emotion recognition (FER) from side profile, we looked for clear association between side view FER and robot social navigation experiments. Among resulted 7 studies only 3 studies included side view but along with walking trajectories.
Further, reviewed side-view FER works without HRI revealed most exercised approaches, face normalization and transfer learning.

RESULTADOS

Face normalization is a common technique used to obtain a front view of a side face using, Generative Adversarial Network (GAN) but emotion related information is lost during the construction process (Hsu and Tang, 2020).



Advanced GAN methods could be effective to generate front profile with embedded emotions (Deng et al., 2019, Dong et al., 2023). No code or model is provided by the authors.

Among Transfer Learning based studies, at least two studies showed better performance on in-the-wild datasets (Debnath et al., 2022, Greco et al., 2023). Akhand et al. (2021) fine-tuned DenseNet modela and tested on predefined datasets. These studies provide their code but not fine-tuned model.

Test image	Fine tuned **DenseNet (161)** model when trained on *KDEF* data, identified emotions as: **Disgust**	Fine tuned **DenseNet (161)** model when trained on *FER2013* data, identified emotions as: **Happy**	**DeepFace** (Open Source Facial Recognition Library) identified emotion as **Happy**
	[Ref: Akhand et al., 2021]		

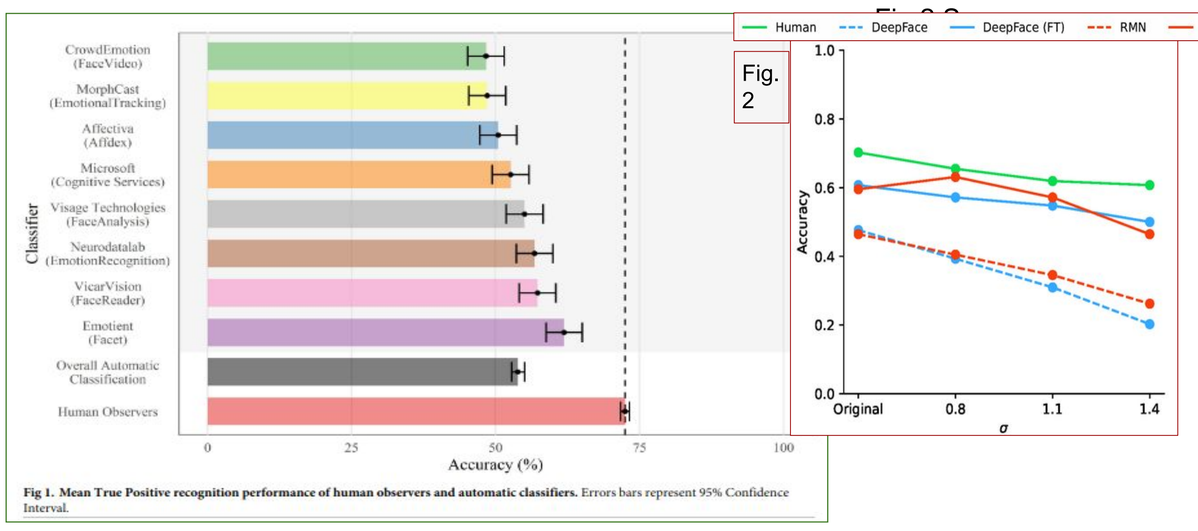


Fig. 2

Fig 1. Mean True Positive recognition performance of human observers and automatic classifiers. Errors bars represent 95% Confidence Interval.

Fig. 1 Source: Dupré et al. (2020)

With two dynamic datasets **Dupré et al. (2020)** compared FER performance of humans with eight commercial frameworks and **Lévêque et al. (2022)** compared robustness in FER by humans and deep neural networks with in-the-wild dataset.

In both studies, **Humans outperformed!**

CONCLUSÕES

- Recent surveys and reviewed studies express the need of robust FER model against varied head poses, focus, illumination conditions, presence of occlusions, different resolutions of faces, basic and complex emotions with varied intensities to outperform human recognition rate in real-world scenarios.
- Yet no study have considered only side face view for emotion recognition, but have opted for walking gait, trajectories or physiological signals during HRI.
- Advanced face normalization-generation and Transfer Learning methods will lend a hand. With this information, further step is to build FER model.

REFERÊNCIAS

[1] Paiva, P.V., Batista, M.R., Cruz, M.V., Germano Filho, B. and Ramos, J.J., 2020, November. ROSANA: Robot for Social Interaction in Unstructured Dynamic Environments. In 2020 Latin American Robotics Symposium (LARS), 2020 Brazilian Symposium on Robotics (SBR) and 2020 Workshop on Robotics in Education (WRE) (pp. 1-6). IEEE.

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