Teaching Emotion Expressions to a Human Companion Robot

Nikhil Churamani, Matthias Kerzel, Erik Strahl, Pablo Barros and Stefan Wermter

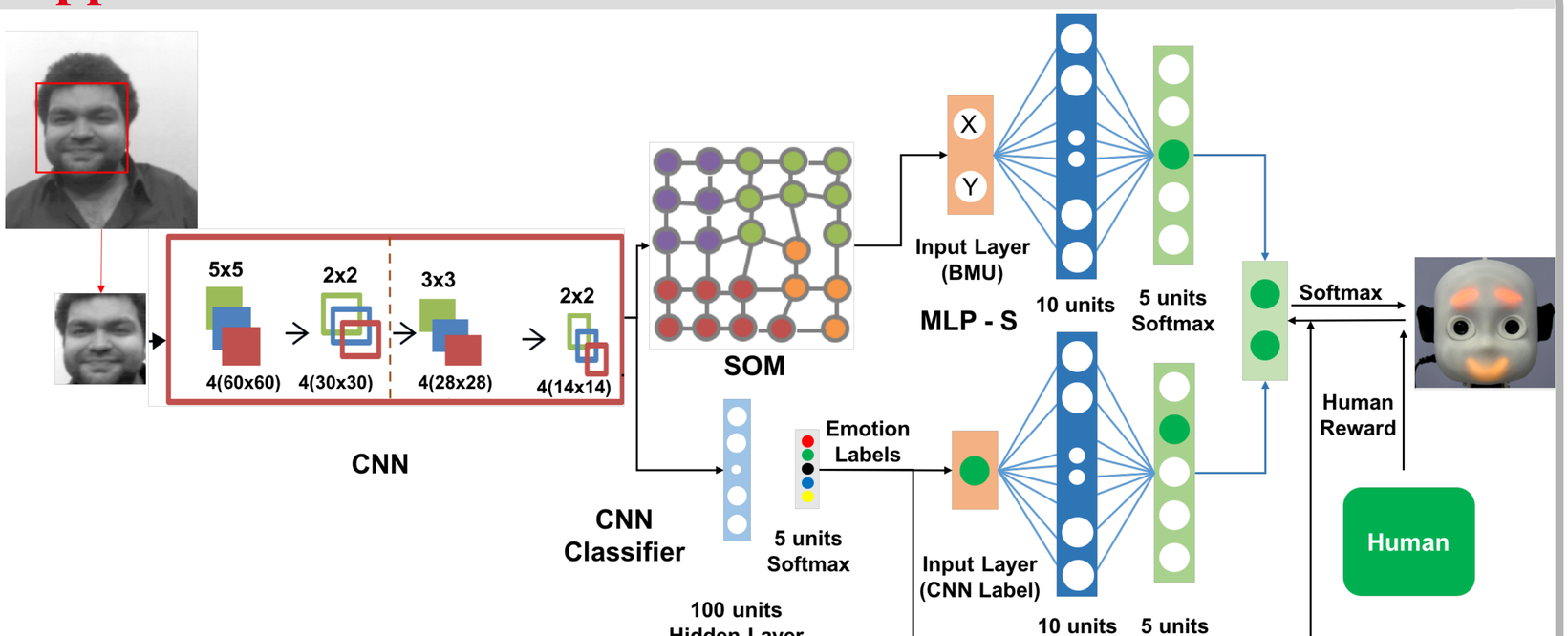
Knowledge Technology, Dept. Informatics, University of Hamburg, Germany

Email: 5churama@informatik.uni-hamburg.de

Motivation

- For better decision making and a pleasant user experience, agents need to be **more sociable.**
- It is important for agents to not only recognise emotions but also to be able to **express emotions** in a way which is apprehensible for humans.
- The motivation behind this study is to explore the possibility of **training agents** to express emotions.
- People express and perceive emotions differently and thus, the agents need to **adapt** to this variance.
- Neuro-Inspired COmpanion (NICO) Robot for neuro-cognitive research.

Approach



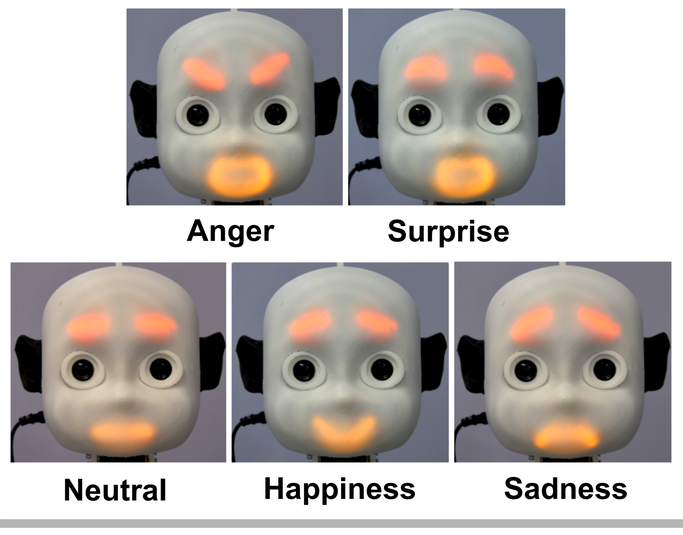
- **CNN** for Facial Feature Extraction
- Feature representations are then used to train the **SOM**. The classifier from the **CNN** is used in parallel to classify emotional input to provide ground-truth.
- Multilayer Perceptron consists of two branches, namely, **MLP-Generic** and **MLP-Specific.**

Scenario

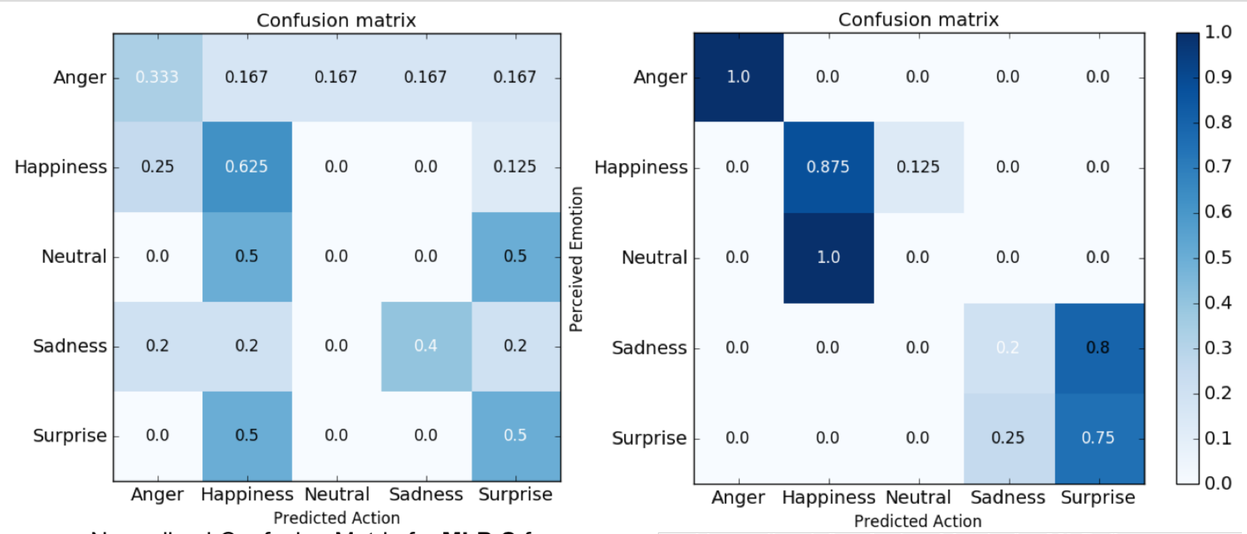
- The CNN is **pre-trained** using the Cohn-Kanade+ dataset and data collected during the experiments.
- For each experiment, the SOM is trained and **customised** to the user's face and expressions.
- Each interaction between the agent and the user can be split into **four** steps:

User Expresses Emotion	CNN classifier and SOM give input to MLPs.
NICO mimics the User	Action selected based on *softmax* from MLP-S and MLP-G
User Rewards NICO.	Image fed to the network as a 'Reward' signal
NICO computes the reward	Positive face gives positive reward and vice-versa.

NICO expression representations used in the study can be seen in the figure below:

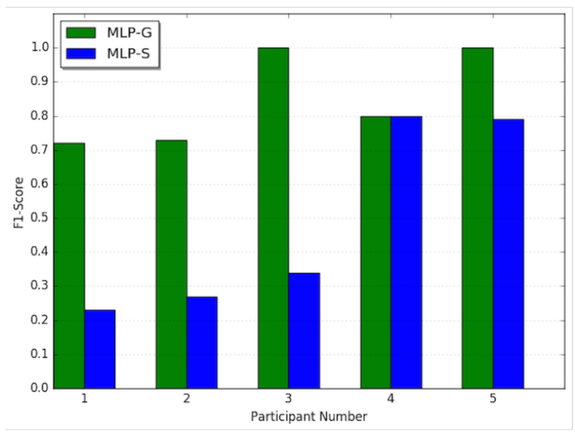


Results

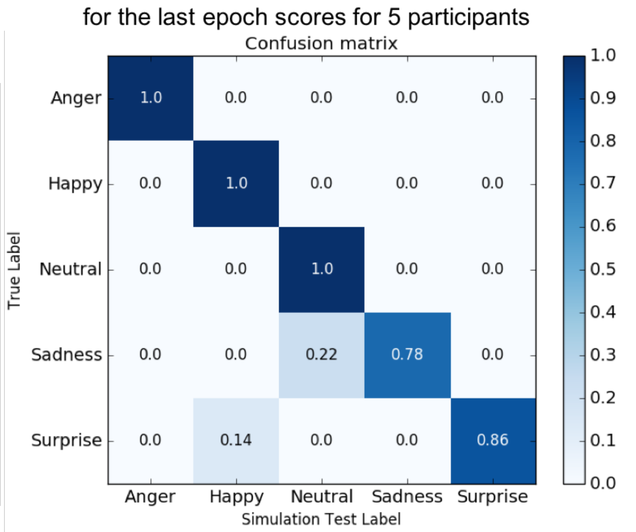


Normalised Confusion Matrix for **MLP-S** for the last epoch scores for 5 participants

Normalised Confusion Matrix for **MLP-G** for the last epoch scores for 5 participants



F1-Score for **continued training** with 5 participants



Final Confusion Matrix for the **Extended Simulation**

Conclusion

- Two branches of the model take inspiration from the generic and specific perception of emotions in humans.
- **MLP-G** acts on the generic, "first impression" model of the network whereas the **MLP-S** learns to adapt to a particular individual.
- Continued training improves performance. MLP-G provides initial guidance but eventually MLP-S outperforms MLP-G adapting to each individual.

References

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Acknowledgements

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