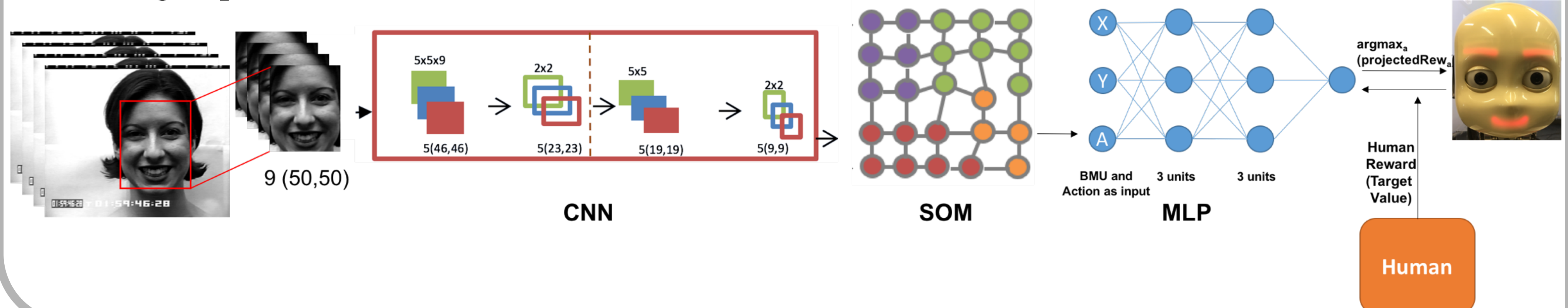


## Motivation

- 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.

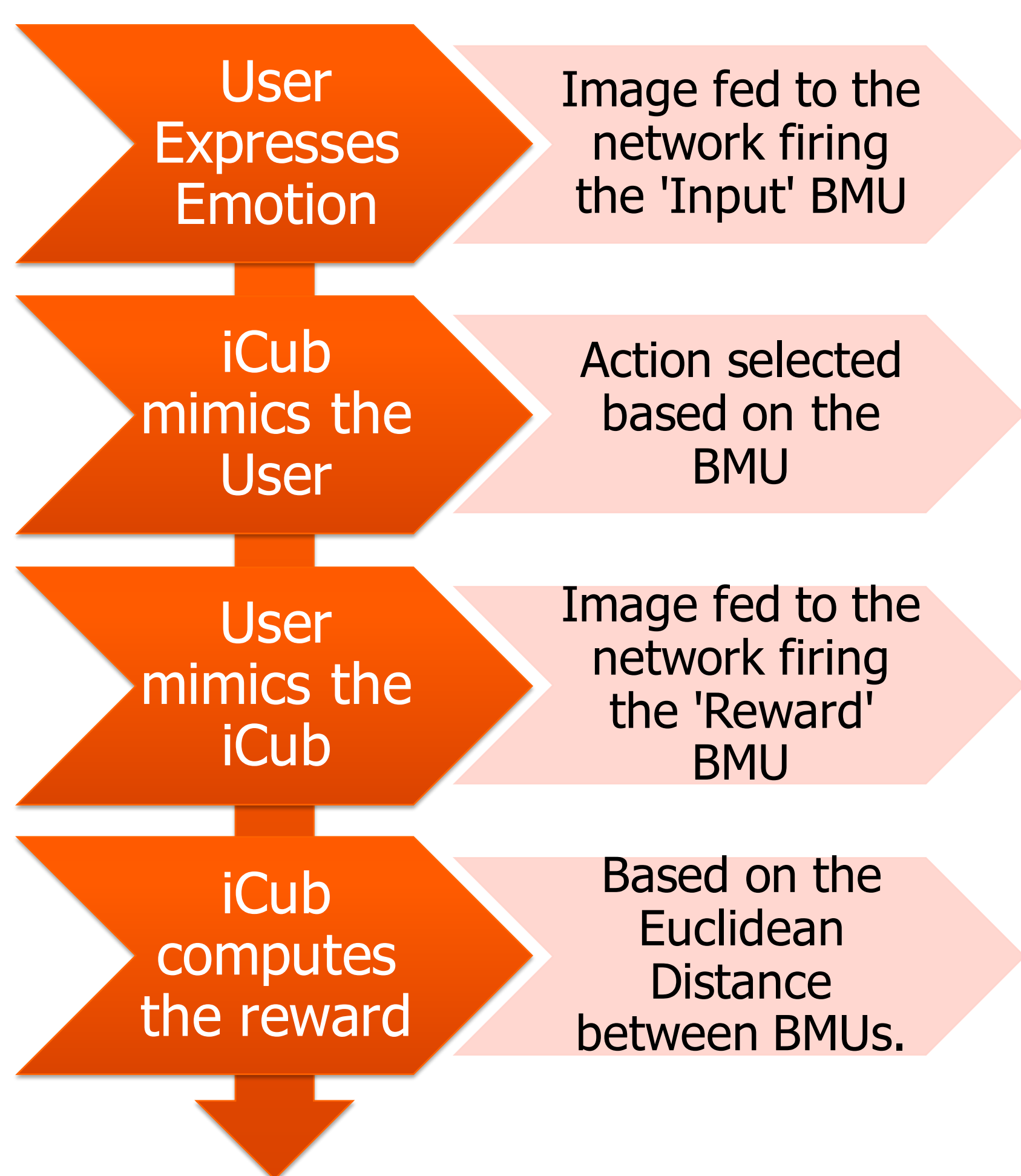
## Approach

- The iCub captures an image of the user's expression which is fed to a pre-trained **CNN** giving it a feature vector representation.
- Feature representations are fed to the **SOM** where clusters emerge pertaining to each emotion.
- User interactions are modelled by taking the **Best Matching Unit (BMU)** from SOM for training an MLP to predict the action which best mimics the user's expression.
- The **user rewards** the robot's action and the MLP is trained to select the correct expression by learning to predict this reward.

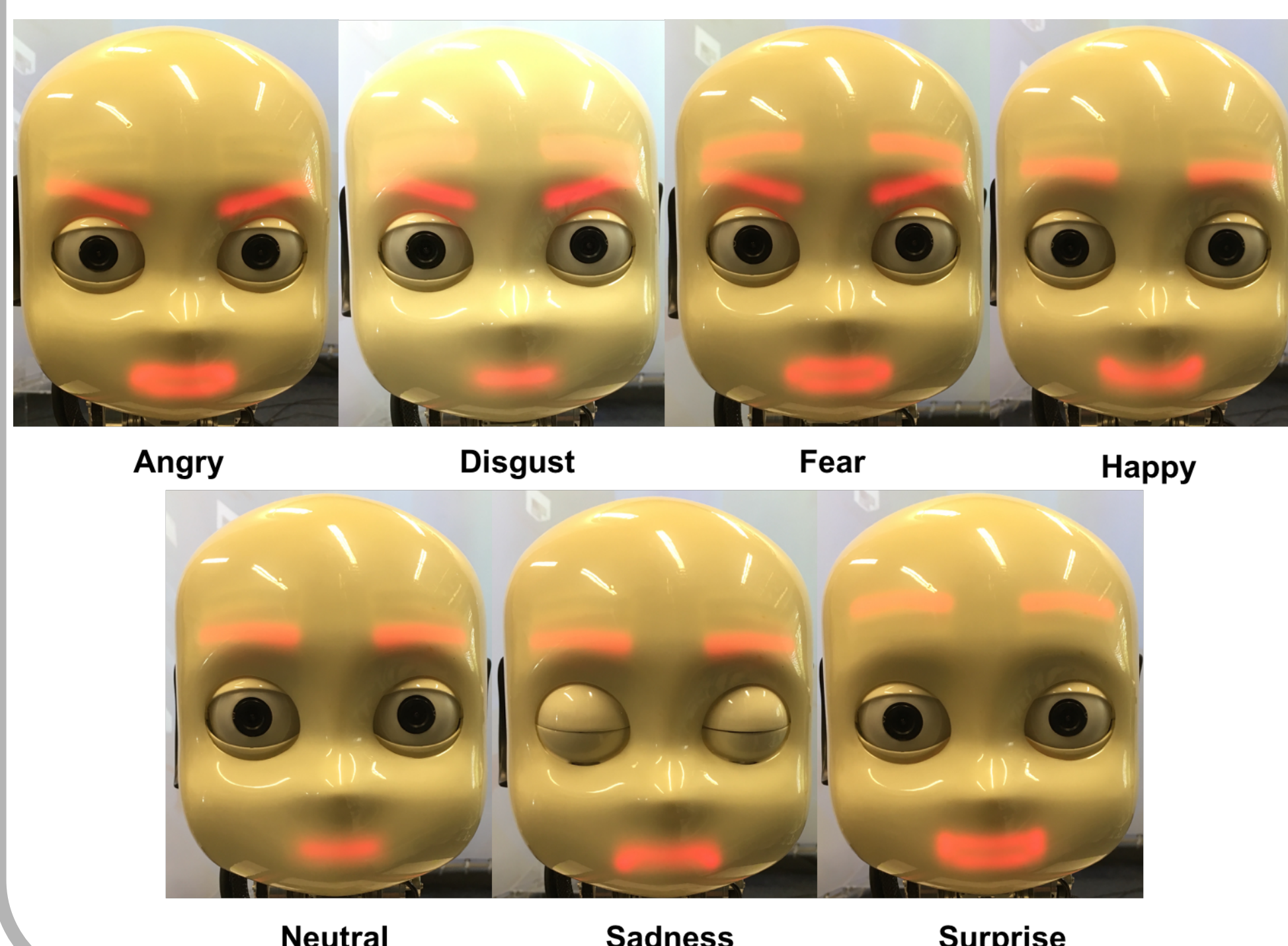


## Scenario

- The CNN is **pre-trained** using the Cohn-Kanade+ dataset.
- 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:

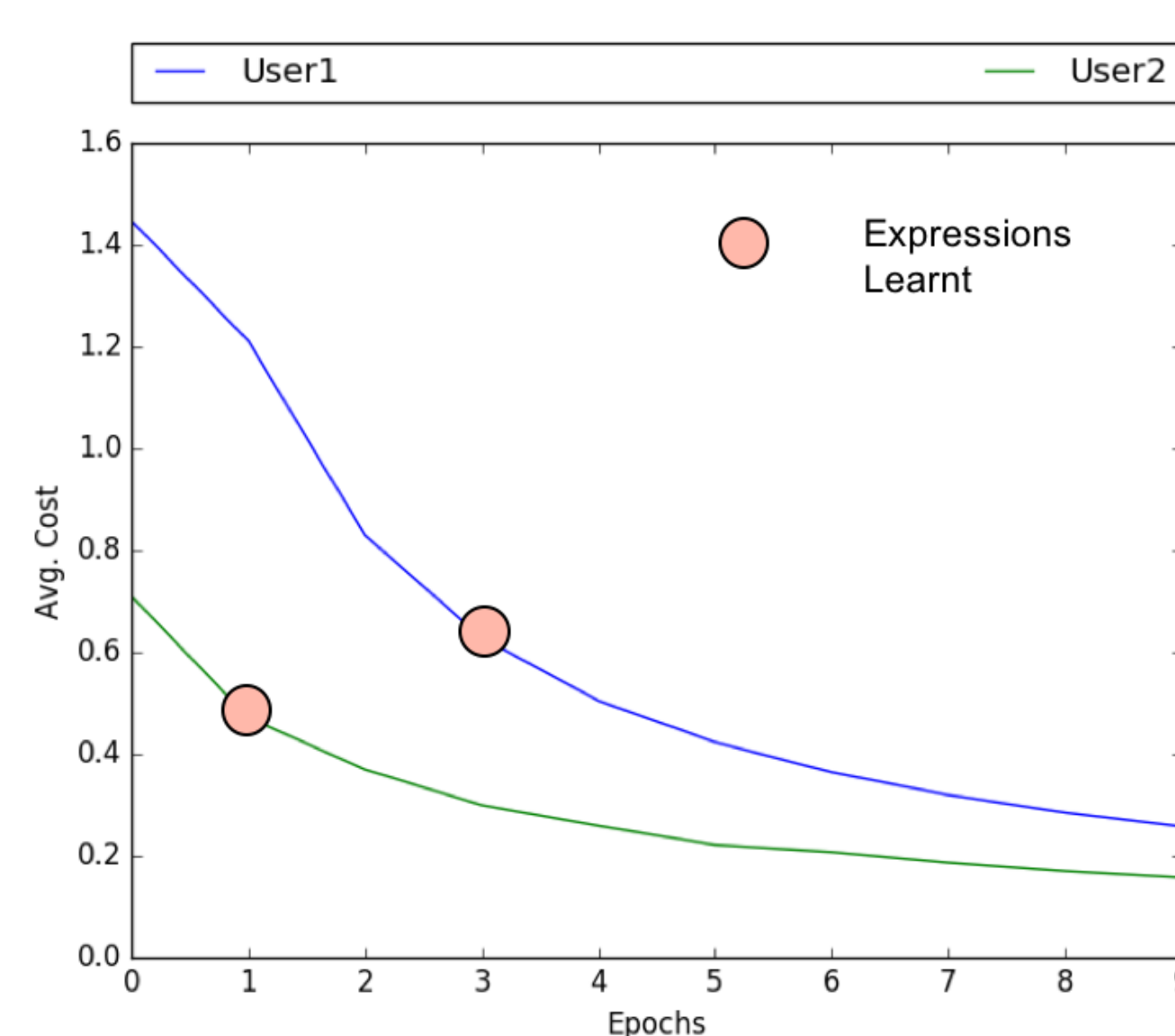


The iCub expression representations used in the study can be seen in the figure below:

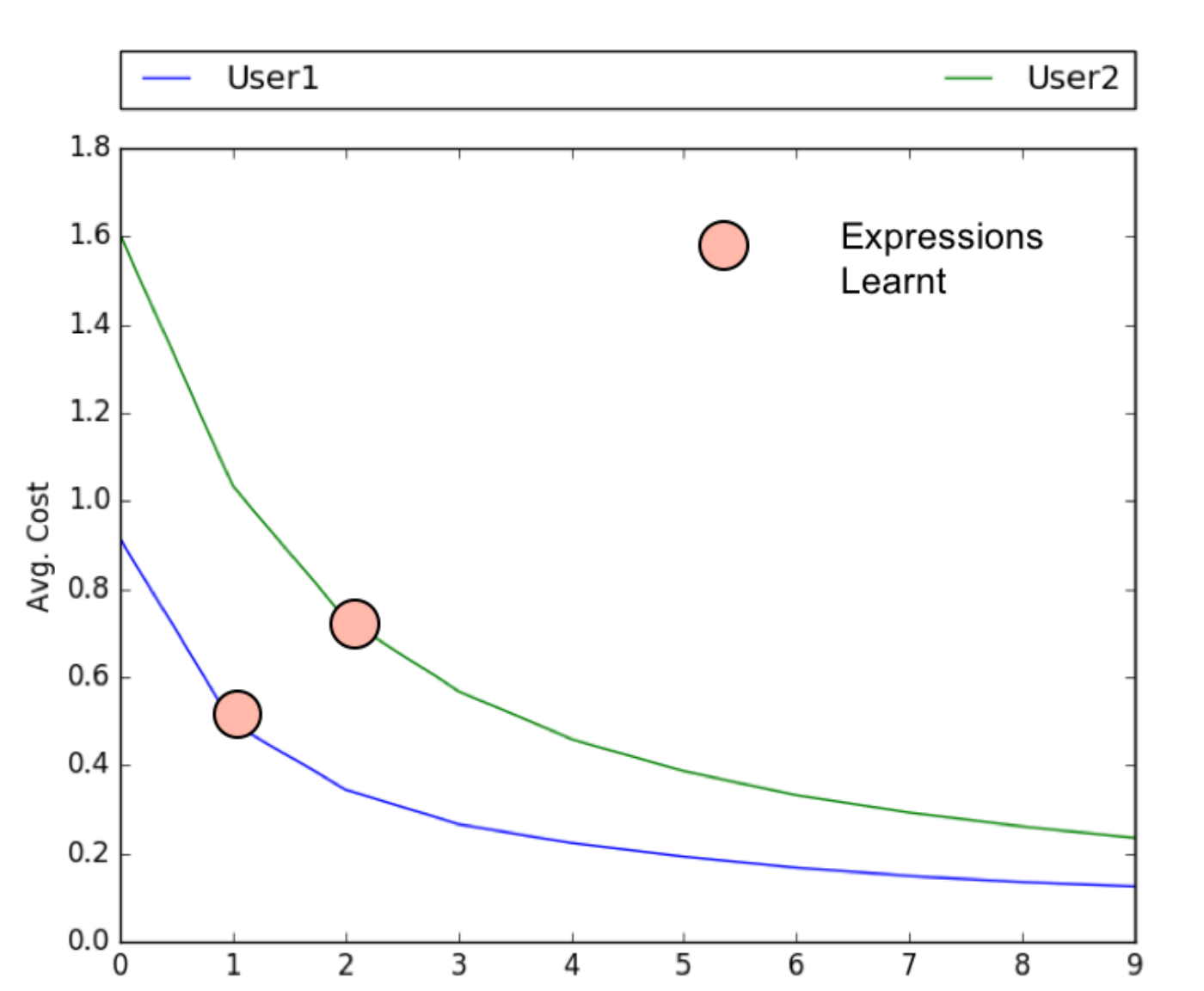
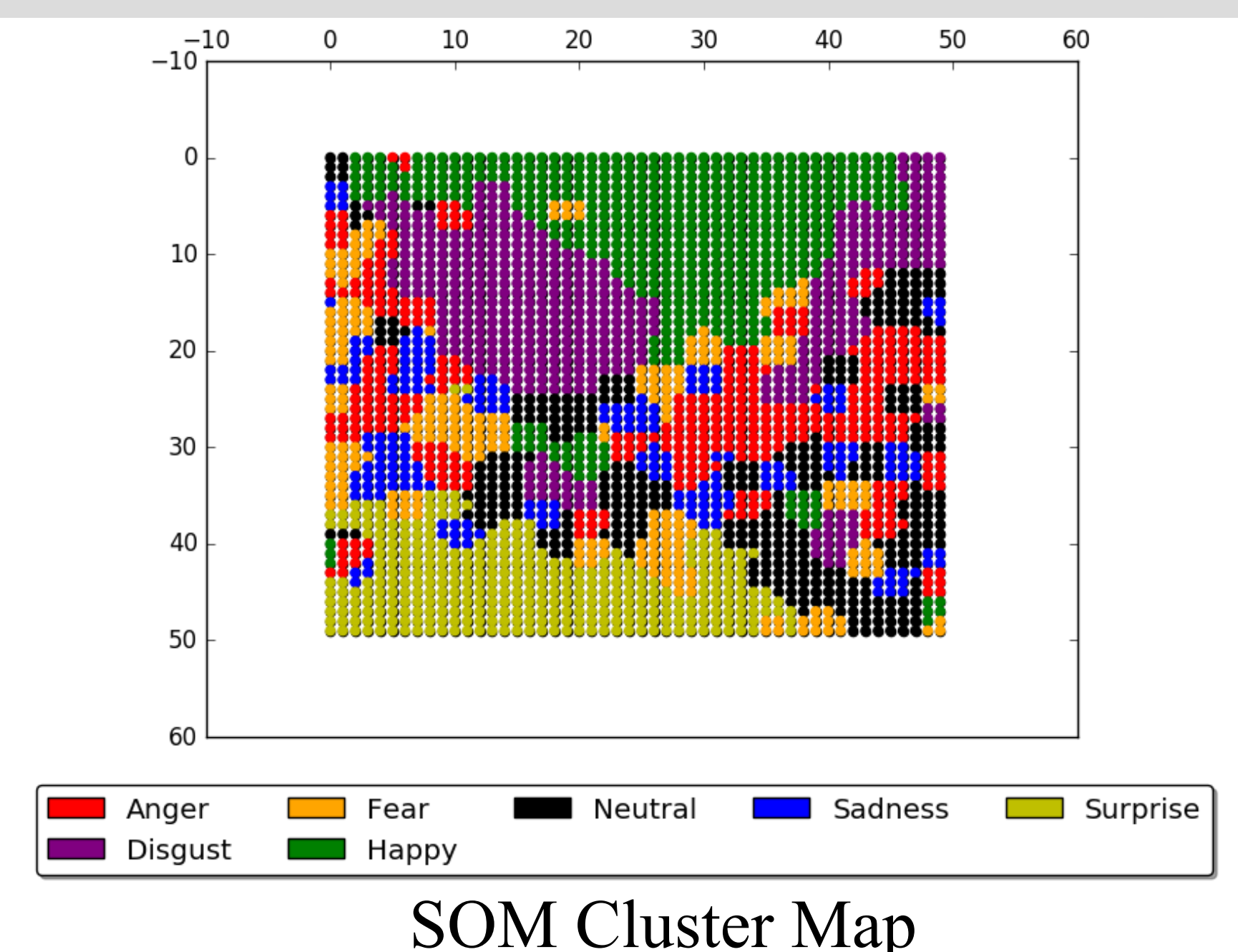


## Preliminary Results

- Clusters** emerge in the SOM corresponding to particular emotions.
- Each epoch corresponds to **100 interactions** for calculating the average cost.
- Experiments conducted with users with and without prior knowledge of the system.



(a) Users with no prior knowledge



(b) Users with prior knowledge

## Conclusion

- Agent associates an expression representation with the respective emotion thus **'learning'** how to express emotions.
- The method still requires **more than 100** interactions per user to learn meaningful expressions.
- This number is **expected to decrease** with improvements in training methodologies and by collecting more data for training.

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