

Motivation-based Social Expression for Agent's Learning Performance Representation

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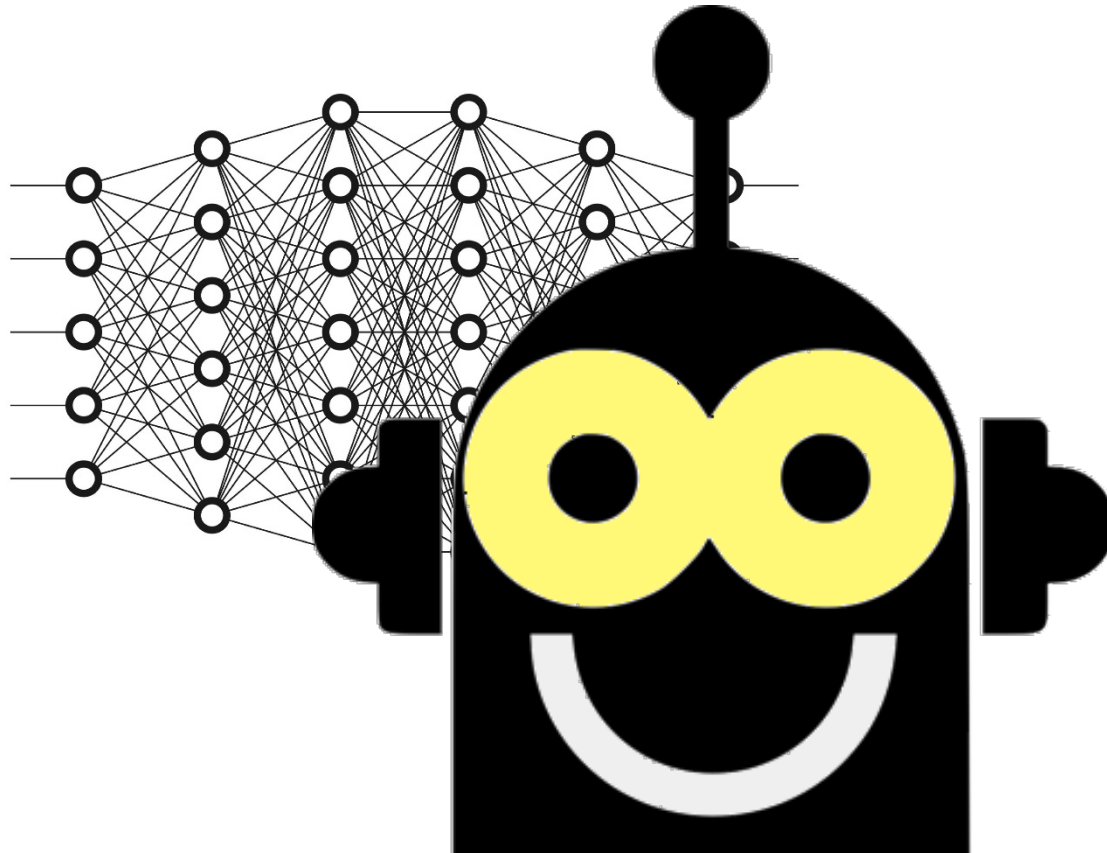
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INTRODUCTION

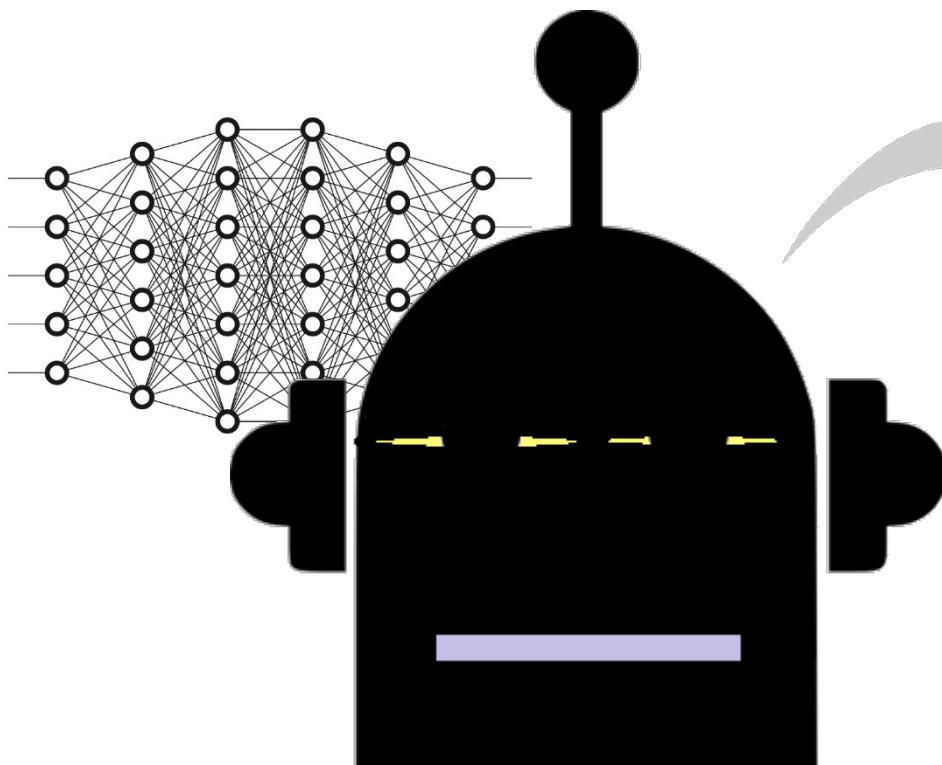
- ❖ **Learning is a key requirement**
 - ✓ for an intelligent agent or a robotic system.



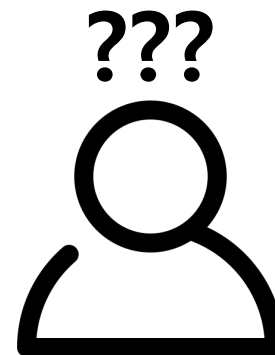
INTRODUCTION

❖ However, common problems is

- ✓ *inaccessibility* of the internal progress of learning to human users
 - processing time that occupies all resources and intercepts continuous interaction
 - lack of representation to help intuitive understanding



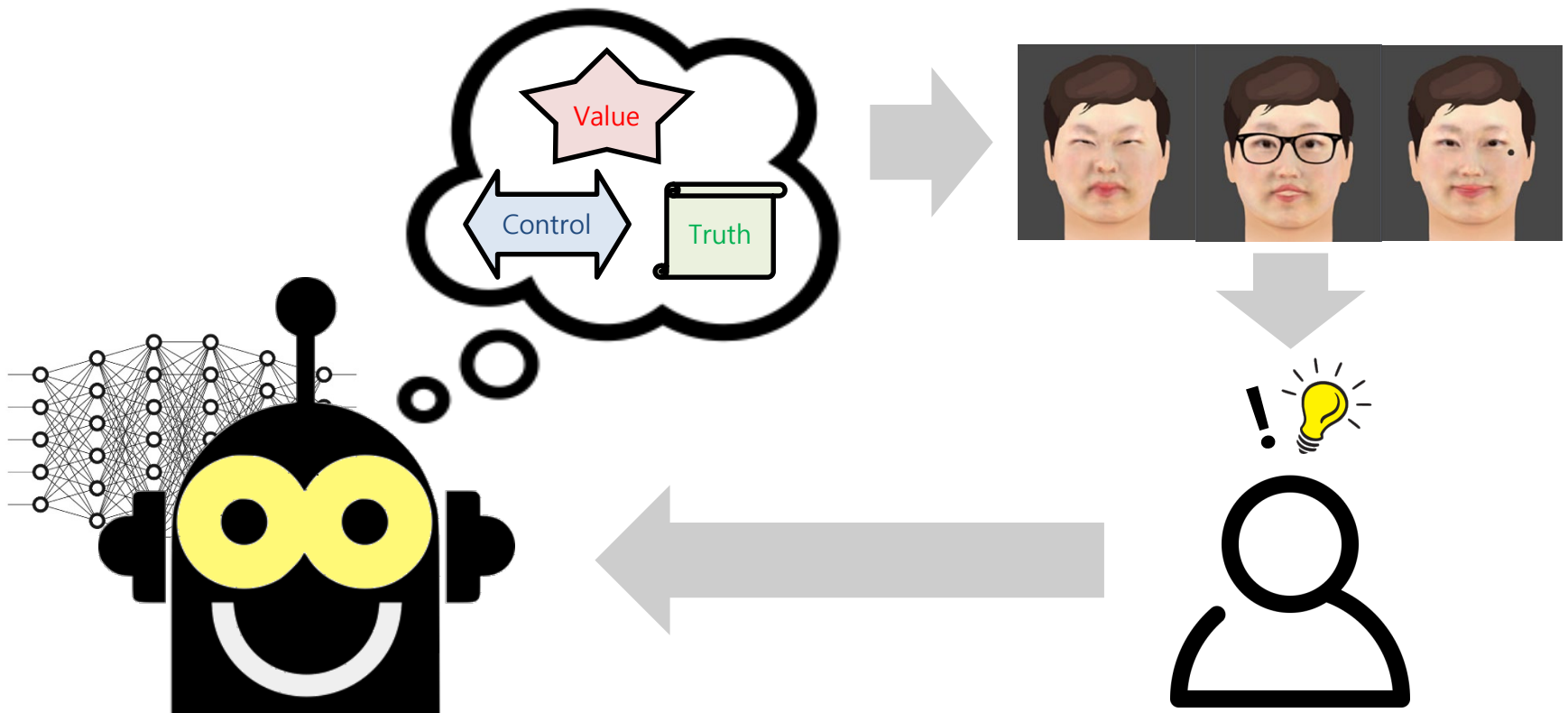
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Epoch 38/50 [-----] - 0s - loss: 0.5305 - acc: 0.7354
18750/18750
Epoch 39/50 [-----] - 0s - loss: 0.5267 - acc: 0.7378
18750/18750
Epoch 40/50 [-----] - 0s - loss: 0.5192 - acc: 0.7466
18750/18750
Epoch 41/50 [-----] - 0s - loss: 0.5237 - acc: 0.7422
18750/18750
Epoch 42/50 [-----] - 0s - loss: 0.5159 - acc: 0.7458
18750/18750
Epoch 43/50 [-----] - 0s - loss: 0.5145 - acc: 0.7494
18750/18750
Epoch 44/50 [-----] - 0s - loss: 0.5073 - acc: 0.7557
18750/18750
Epoch 45/50 [-----] - 0s - loss: 0.5038 - acc: 0.7579
18750/18750
Epoch 46/50 [-----] - 0s - loss: 0.4987 - acc: 0.7629
18750/18750
Epoch 47/50 [-----] - 0s - loss: 0.4980 - acc: 0.7601
18750/18750
Epoch 48/50 [-----] - 0s - loss: 0.4922 - acc: 0.7664
18750/18750
```



PROPOSED METHOD

❖ Thus, we propose

- ✓ a **social expression** method based on the *motivational theory*,
 - by which intelligent agents actively and intuitively inform human users of its learning status
 - and the users can also have sufficient perception to decide when to intervene or manage the agent's learning progress.



PROPOSED METHOD

❖ Learning, Motivation, and Emotion

- ✓ Learners can improve the efficiency of learning by continuously showing their motivational states to teachers to cooperate.
- ✓ Tory E. Higgins proposed a broader and unified definition of motivation:
"Motivation is directing choices in order to be effective in pursuing goals".
- ✓ He described three different ways of being effective in pursuing goals:
 - *value effectiveness*, *truth effectiveness*, and *control effectiveness*, and their relation with emotions.

	Success	Failure
Value Eff.	Cheerful, Quiescent	Dejected, Agitated
Truth Eff.	Confident	Surprised
Control Eff.	Vigorous	Powerless

❖ Computational Motivation Effectiveness Evaluation

✓ Estimated total accuracy estimation: \hat{a}

✓ *Value effectiveness* evaluation:

$$m_v = \min \left(\text{Logit} \left(\frac{\hat{a}}{2} + \frac{1}{2} \right) / C_v, 1 \right)$$

✓ Estimated accuracy difference btw training and test: \hat{a}_d

✓ *Truth effectiveness* evaluation:

$$m_t = \max \left(0, 1 - \frac{\hat{a}_d}{\sigma A} \right)$$

✓ Estimated accuracy change rate: \hat{a}_c

✓ *Control effectiveness* evaluation:

$$m_c = \max \left(0, \frac{\hat{a}_c}{\hat{a}_{c(\max)}} \right)$$

PROPOSED METHOD

❖ Emotion and Expression

$$e_{che} = \max(0, 2(m_v - 0.5))$$

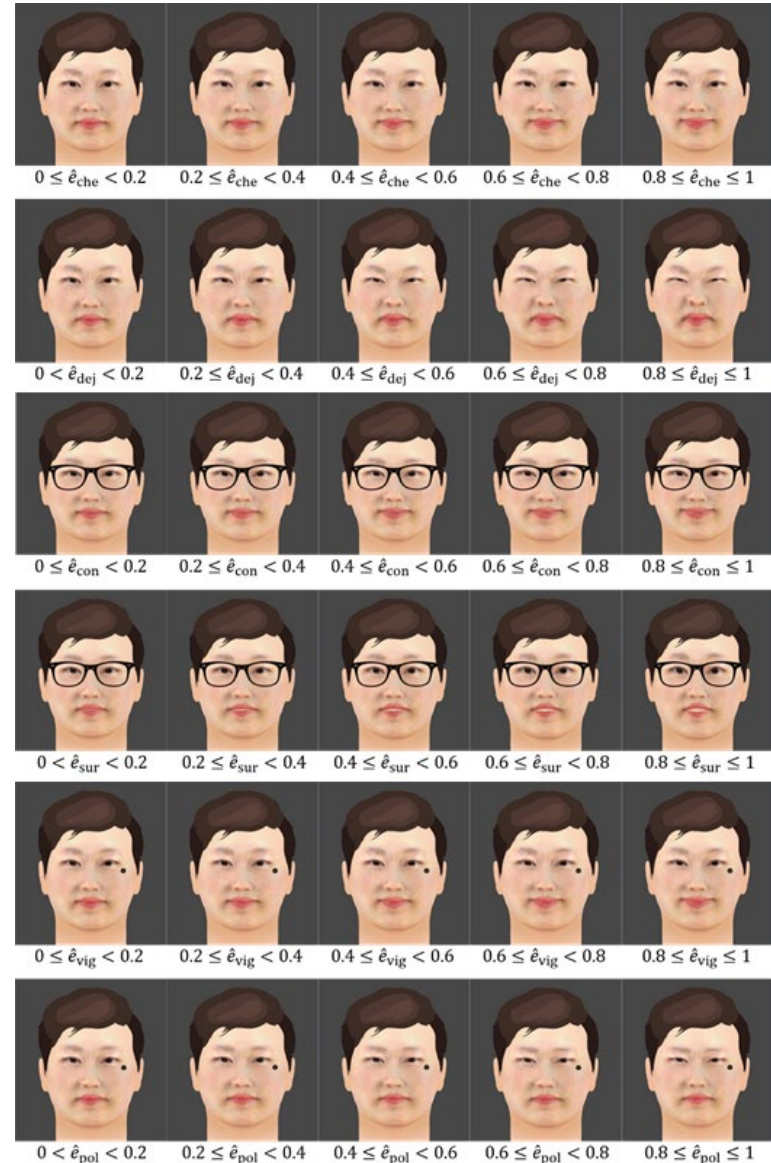
$$e_{dej} = \max(0, 2(0.5 - m_v))$$

$$e_{con} = \max(0, 2(m_t - 0.5)(1 - m_c))$$

$$e_{sur} = \max(0, 2(0.5 - m_t)(1 - m_c))$$

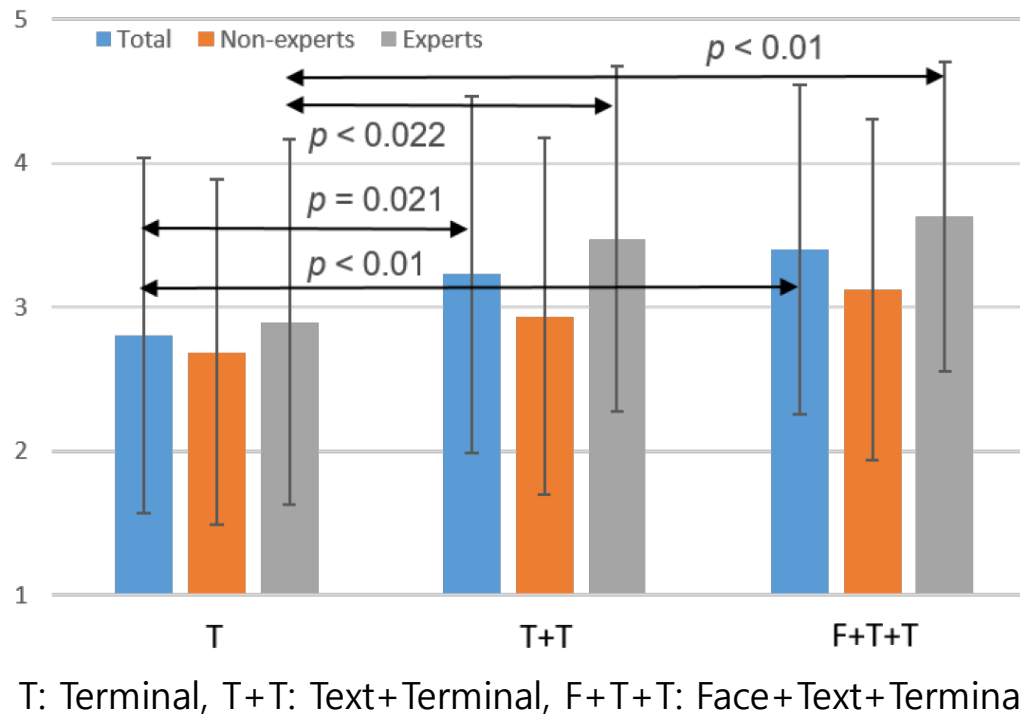
$$e_{vig} = \max(0, 2(m_c - 0.5))$$

$$e_{pol} = \max(0, 2(0.5 - m_c))$$



❖ The user study shows that

- ✓ our model exhibits adequacy of expressing the agent's motivational states and corresponding emotions by displaying its learning processes.
- ✓ Hypothesis: *If an agent learner imitates human motivation during its learning and expresses states and emotions according to learning progress, comparing to conventional machine learning process, human user will more easily understand the agent's learning states.*





Thank you!

INTRODUCTION

❖ Learning is a key requirement

- ✓ for an intelligent agent or a robotic system.

❖ However, common problems are

- ✓ inaccessibility of the internal progress of learning to human users
 - not only because of the processing time that occupies all resources and intercepts continuous interaction
 - but because of the lack of representation to help intuitive understanding

❖ Thus, we propose

- ✓ a social expression method based on the motivational theory,
 - by which intelligent agents actively and intuitively inform human users of its learning status
 - and the users can also have sufficient perception to decide when to intervene or manage the agent's learning progress.

❖ The user study shows that

- ✓ our model exhibits adequacy of expressing the agent's motivational states and corresponding emotions by displaying its learning processes.
- ✓ We expect that our proposed design and approach can provide new perspectives on human-agent interaction in dynamic learning scenarios.