

## Learning Outcome Prediction

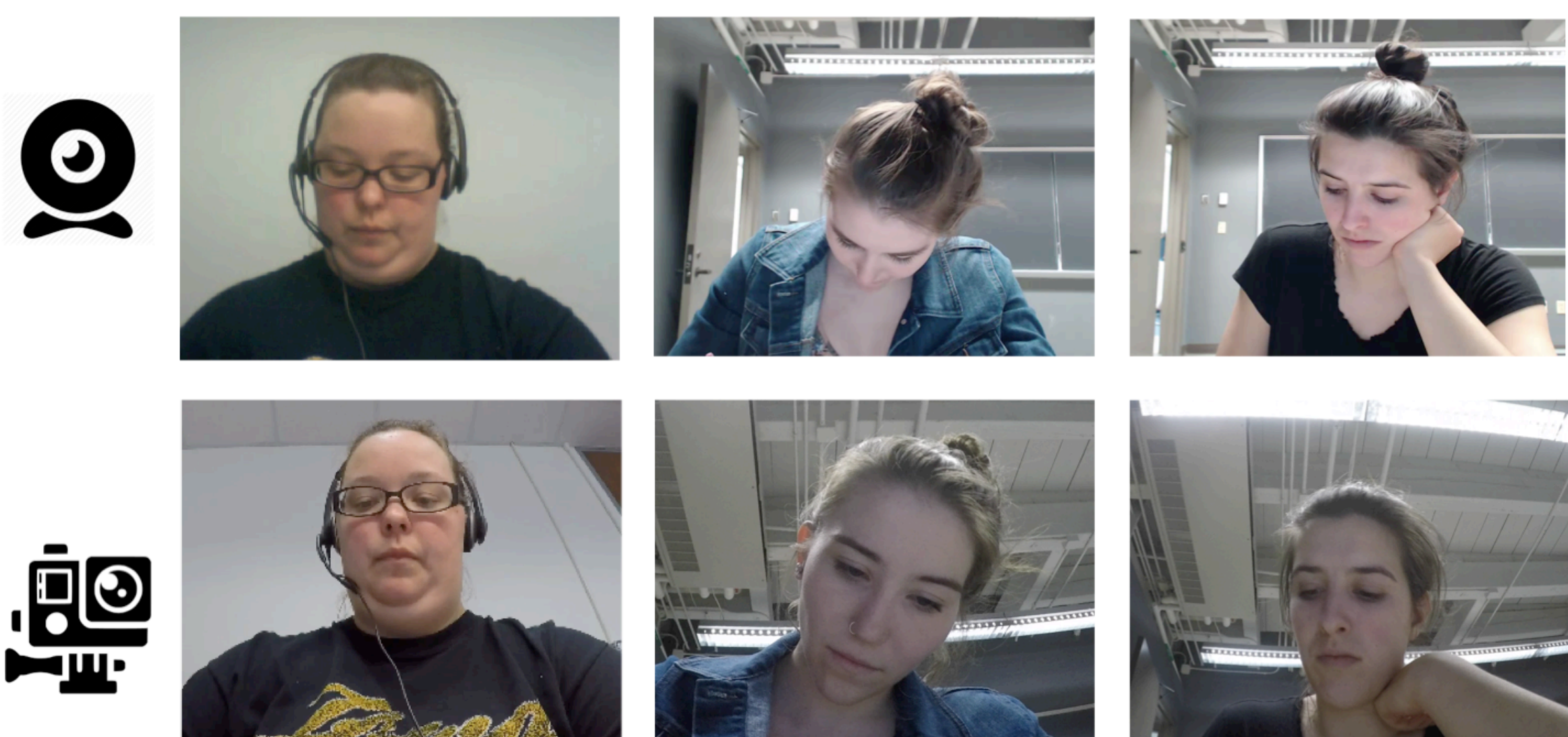


- Can we build an Intelligent Tutoring System that can forecast the problem outcome label from a video of a student interacting with it?

## Overview

- We introduce a novel dataset of student interactions with MathSpring, a popular Intelligent Tutoring System.
- We provide an exploratory analysis of the different problem outcome classes using typical facial action unit activations.
- We develop baseline models to predict the problem outcome labels of solving math problems.
- We discuss how early problem outcomes can be forecasted and utilized to provide possible interventions.

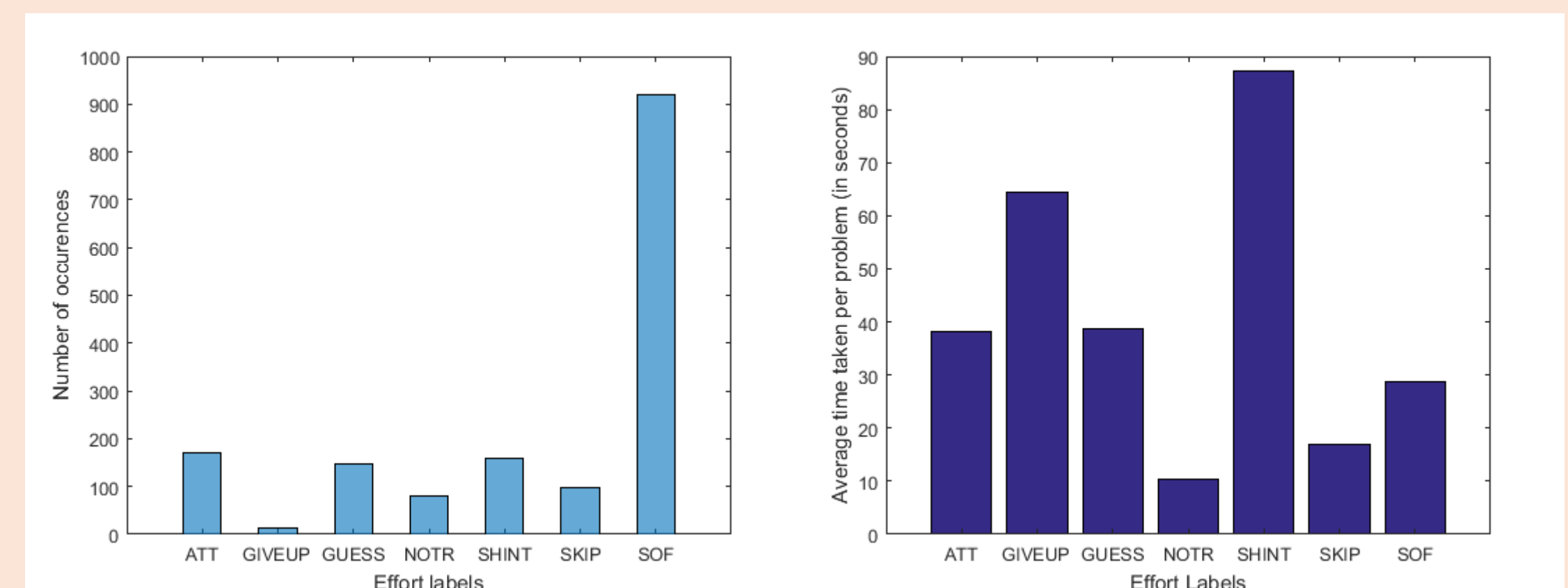
## MathSpring Student-Interaction Dataset



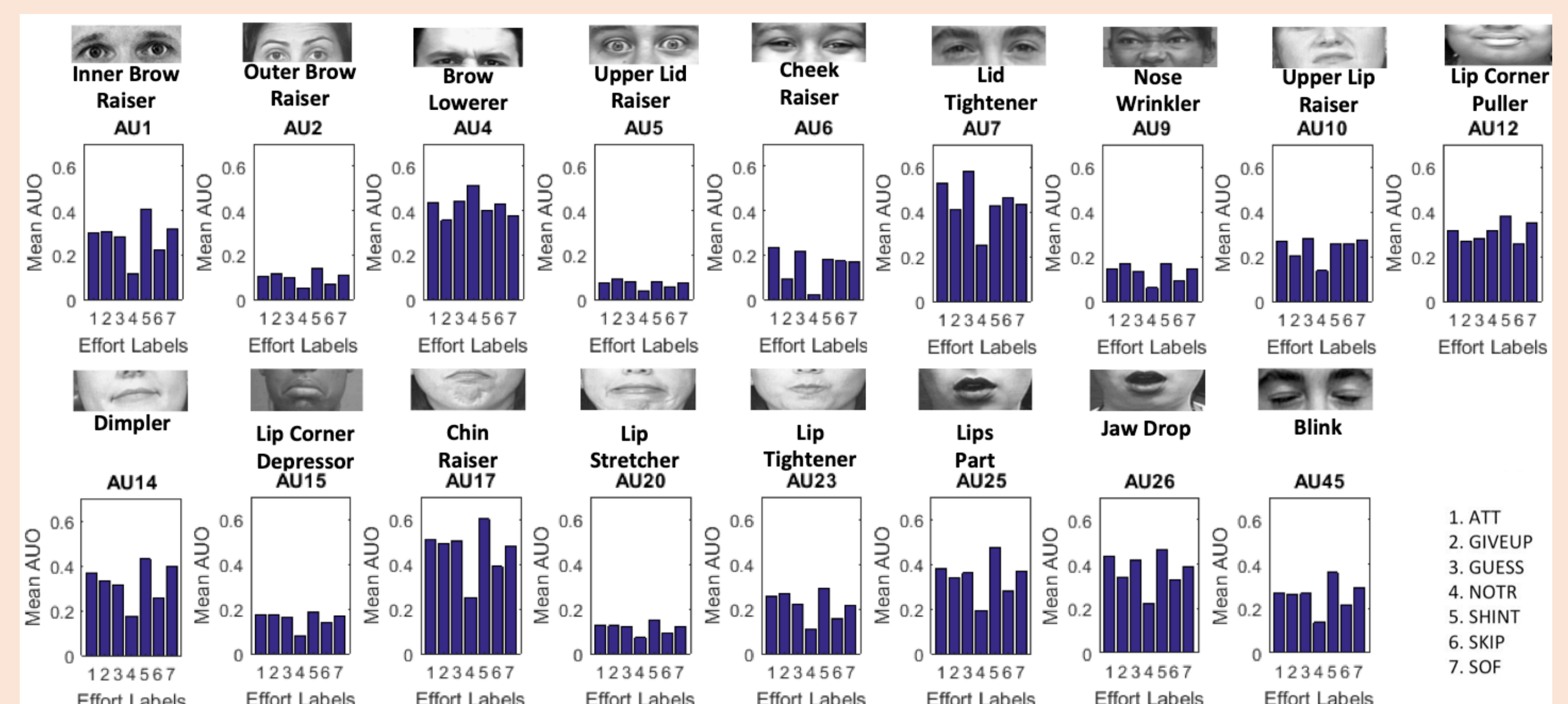
- The dataset consists of video recordings of college students participating in problem-solving sessions in MathSpring.
- The students were recorded with a webcam and a GoPro
- A total of 30 undergraduate college students took part in the study, resulting in 38 one-hour sessions, from which 1596 problem samples were extracted.

## Data Analysis

- Number of Occurrences and average time taken to complete for each class in the dataset

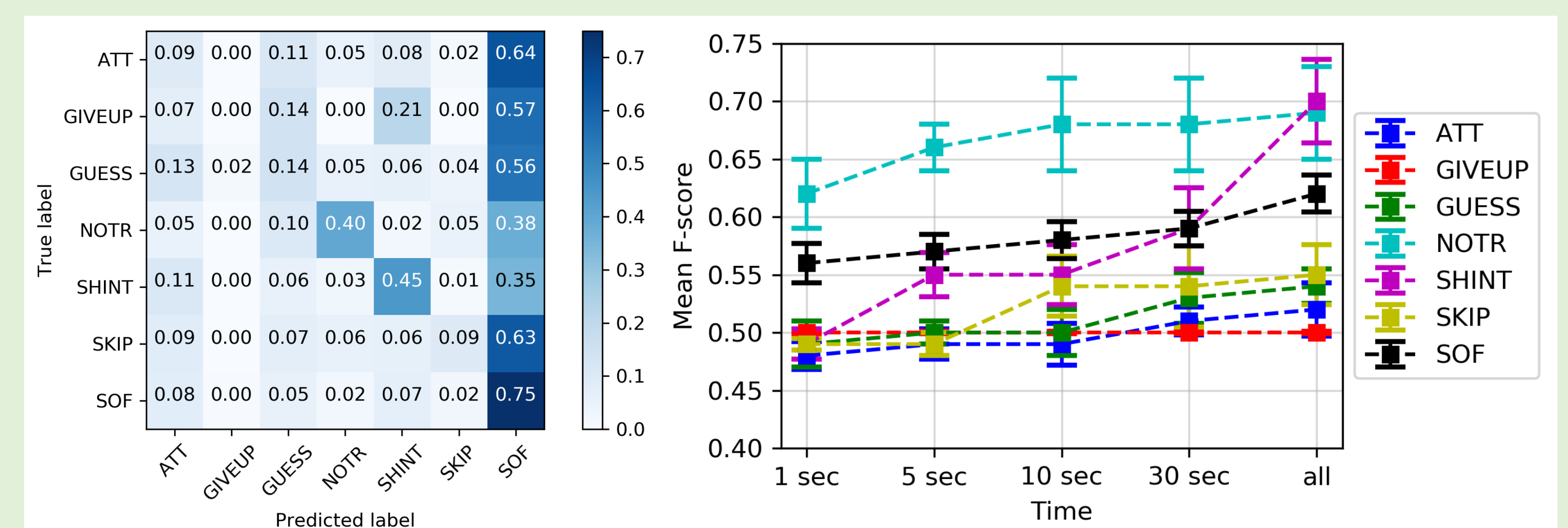


- Average Action Unit Occurrence distributed according to student outcome prediction labels



## Baseline Models

- For each video, we computed statistics (mean, std, min, max) from 18 facial activation presence and 17 facial activation intensity values as well as their derivatives.
- We trained and tested multi-layer perceptrons with 2 hidden layers, each with 100 activation nodes, on 5 random 75-25 stratified splits of the data.



## Future Work

- Utilize signals from all streams of information in the dataset (GoPro videos, mouse movements/clicks).
- Train models that explicitly model the temporal dynamics of how facial dynamics evolve over the duration of the interaction.
- Utilize models to provide interventions to improve learning.