Wits Intelligent Teaching System (WITS)

Contingent Teaching [1] requires being responsive to students’ needs during class.

- Lecturers need to be able to assess the state of the audience at a glance.
- Take steps to positively impact learning.

WITS is an automated system to report on behavioral engagement.

### Behavioral Engagement

- Direct labelling resulted in poor inter-rater reliability (Cohen's Kappa).
- Observational checklist looks for common behaviors.

**Engaged:**
- Writing Notes
- Asking Questions
- Looking at the Lecturer/Notes
- Straight/Upright Posture

**Not Engaged:**
- Cellphone
- Sleeping
- Looking at the roof/friends/under desk/etc.
- Yawning
- Slouched Posture, Head on Desk, etc.
- Talking with Friends

### Data (WITSdb)

- 3x45 Minute First Year Lectures Recorded
- UHD (4K) Resolution
- 8 FPS
- 65 Unique Subjects – varying number per lecture
- Labelled by multiple raters, labels with low inter-rater reliability were discarded.

### Results

**Frames (All Subjects)**

- Highly Correlated in Time
- HOg SVM: 72.6% testing accuracy, 73% validation accuracy
- CNN: 89.6% testing accuracy; 89.6% validation accuracy (k=0.792)

**Lecture 1 Subjects Only**

- Balanced Validation Set: 441 154 labelled images
- 50 Subjects, 50 Fold Cross Validation
- Random Chance: 50% accuracy
- HOg SVM: 53.5% accuracy on validation set
- CNN: 59% accuracy on full validation set
- Max Accuracy: 91.5%
- Min Accuracy: 50%
- Mean Accuracy: 65.6%

### Future Work

- Increase data set variety
- Increase labels
- Apply Sequence Methods (eg. LSTM) to learn image sequences

---