# Learning based Visual Engagement and Self-Efficacy

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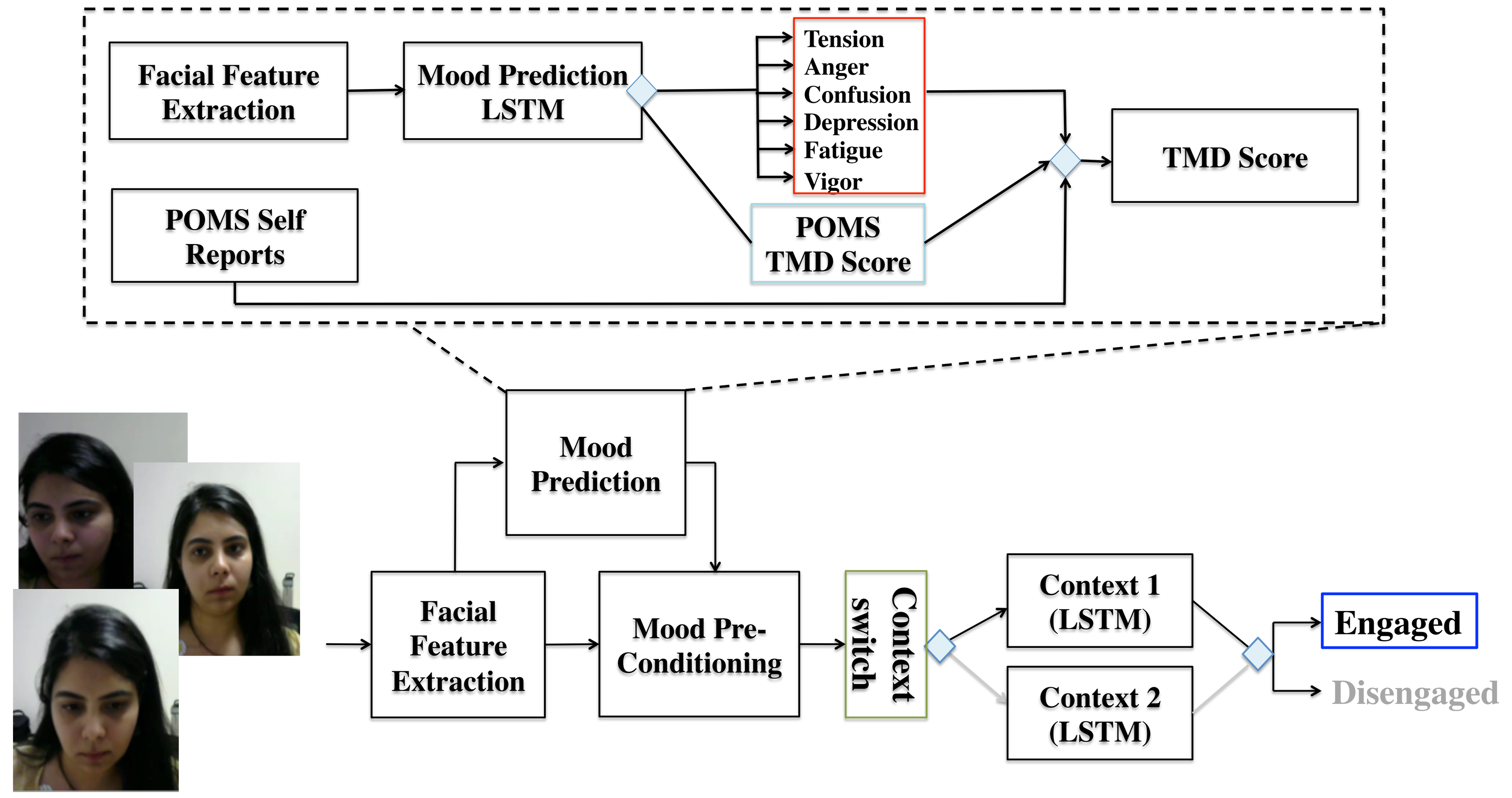
## Application: Trauma-Recovery

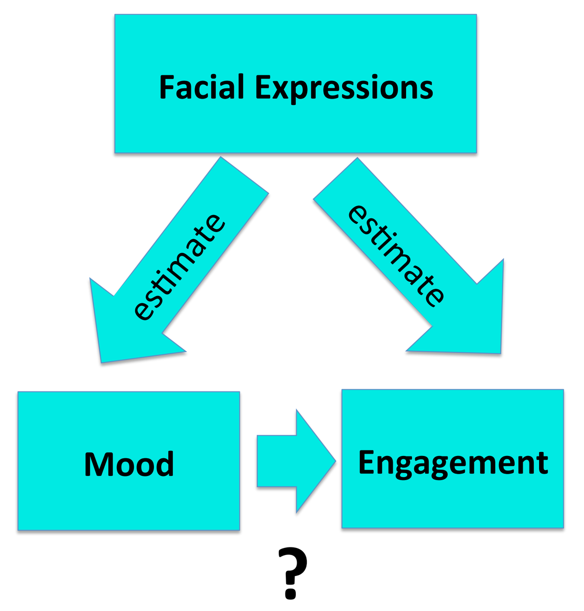
1. Each year, over 3 million people in the United States are affected by post-traumatic stress, a serious mental condition.
2. Mental trauma is often associated with symptoms like, avoidance of treatment, negative beliefs, hyper arousal, cognitive impairments etc.
3. Self-help web interventions for mental health effectively follow a one-size-fits-all approach.
4. Personalization and automated adaption in self-help websites can positively aid people with mental health issues.

## Why Engagement and Self-Efficacy?

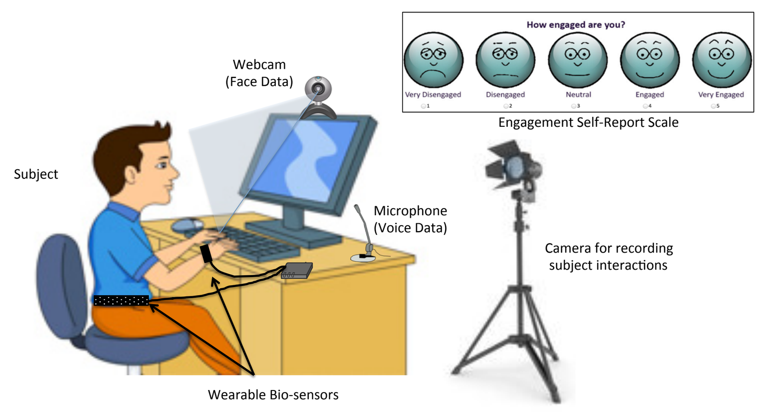
1. Engagement is an indispensable part of user experience and interaction with applications.
2. Vision and learning based methods can provide a proactive, scalable and cost-effective web-based treatment for trauma recovery by analyzing webcam feeds.
3. Self-reported user efficacy has been found, in many psychology studies, to be highly correlated with outcomes.
4. Self-efficacy is a key component of social cognitive theory and refers to a perceived capability to cope with challenges and uncertainty in stressful situations.
5. The website and task can adapt to enhance or maintain engagement and recovery based on reliable and quantitative engagement and self-efficacy measurement.

## Mood-aware Contextual Engagement Pipeline



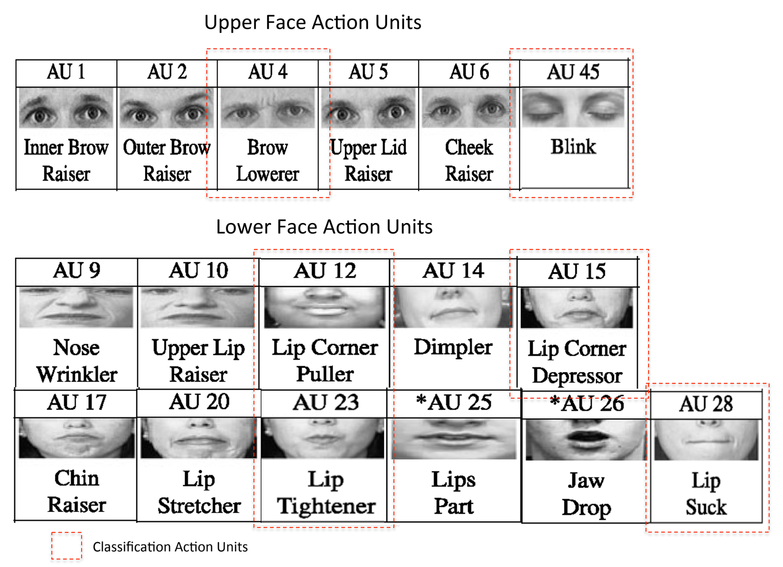




## EASE Dataset




| | SESSION 1 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | MODULE 1 | | | | MODULE 2 | | | |
| | Task | Number of Videos | Number of Frames | Number of Self Reports | Task | Number of Videos | Number of Frames | Number of Self-Reports |
| Trigger Task followed by Relaxation Task | Trigger | 52 | 806855 | 166 | Relaxation | 52 | 1579927 | 122 |
| Relaxation Task followed by Trigger Task | Relaxation | 43 | 1391803 | 91 | Trigger | 43 | 590953 | 98 |

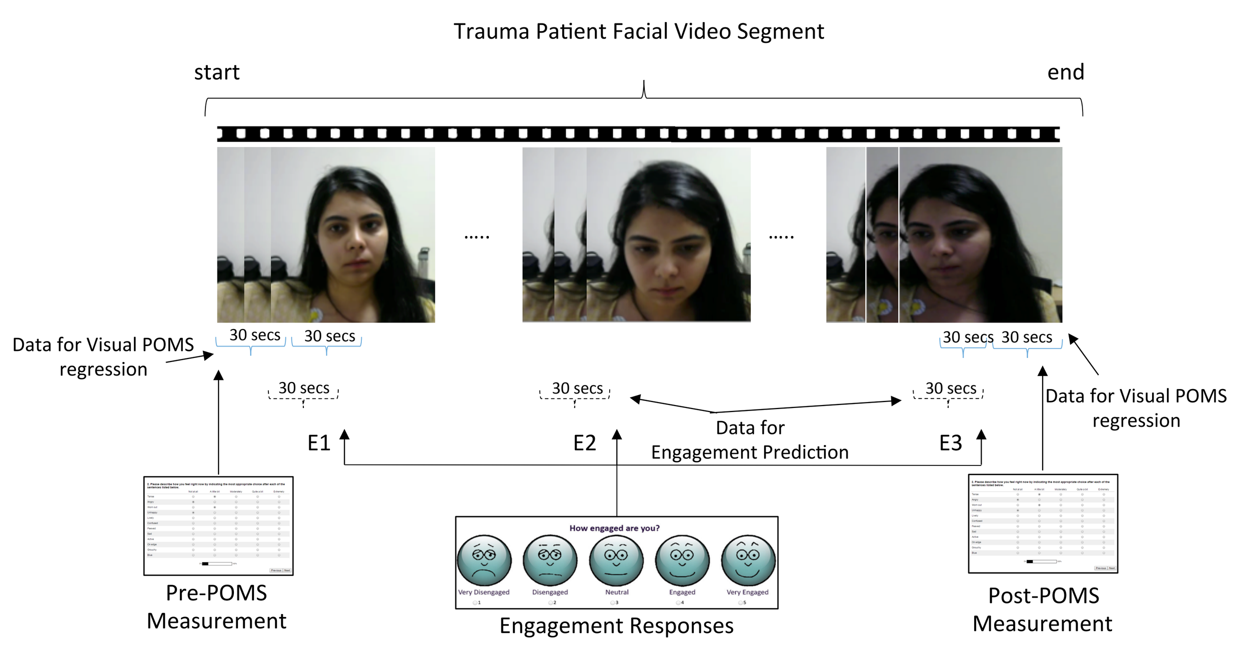
| | SESSION 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | MODULE 1 | | | | MODULE 2 | | | |
| | Task | Number of Videos | Number of Frames | Number of Self Reports | Task | Number of Videos | Number of Frames | Number of Self Reports |
| Trigger Task followed by Relaxation Task | Trigger | 33 | 454510 | 94 | Relaxation | 33 | 1553409 | 63 |
| Relaxation Task followed by Trigger Task | Relaxation | 47 | 1139996 | 105 | Trigger | 47 | 544298 | 149 |




### Dataset Details

1. Web-intervention used for trauma-recovery : *http://ease.vast.uccs.edu/*.
2. Participants consisted of total 110 subjects with 88 Female, 17 Male, 5 did not specify in the age group of 18-79 years, with 80% being under the age of 46.
3. Study comprised of 3 Sessions using six Modules of trauma-recovery: Relaxation, Triggers, Social-Support, Self-Talk, Professional-Help, Unhelpful-Coping.
4. Face data, audio and sensory data (skin conductance, respiration, ECG) was captured from subjects while they were interacting with website while performing self-regulation exercises.
5. Self-Reports were collected from subjects about their engagement level, mood (Very Short Profile of Mood States (POMS) questionnaire) and self-efficacy measures.

## Video Segment Selection




## Contributions

1. Demonstration of contextual engagement in two different tasks within the recovery regime: "Relaxation" and "Triggers".
2. Explored relationship of subject's mood as an initialization parameter for engagement estimation.
3. Developed automated mood predictors for mood sub-scales and total mood disturbance.
4. Automated mood-aware predictors outperform self-reported mood-aware predictors for engagement.

## Results and Publications

| | RX - Test | TR - Test |
|---|---|---|
| RX - Train | 39.1 ± 8.8 % | 38.1 ± 4.4% |
| TR - Train | 36.7 ± 3.3% | 50.7 ± 11% |
| (RX + TR) - Train | 39.5 ± 6.1% | 49.1 ± 7.6% |

| | RX | TR |
|---|---|---|
| LSTM Baseline | 0.9989 | 0.7653 |
| POMS-aware LSTM | 0.9493 | 0.6786 |

| | Trigger | Relaxation |
|---|---|---|
| Engagement-baseline | 48.55 ± 17.7 % | 42.04 ± 11.7 % |
| Engagement-Mood Aware **POMS-SR** | 52.57 ± 17.2% | 43.88 ± 11.9 % |
| Engagement-Automated MA **POMS-TMD** | 54.04 ± 18.14 % | 46.14 ± 14.38 % |
| Engagement-Automated MA **POMS-TMDS** | 55.54 ± 18.43 % | 45.42 ± 12.99 % |

### Experiment Details

1. **Features:** 20 AUs using OpenFace Framework each from 30 sec video segment (900 frames/segment).
2. **Algorithms:** Support Vector Classification and LSTM based classification for Engagement Prediction. LSTM based regression for automated mood-predictors.
3. **Learning Protocol for Contextual Engagement Models:**
   - Training on Relaxation Module, Testing on Trigger Module & Relaxation Module
   - Train on Trigger Module, Testing on Trigger Module & Relaxation Module
   - Training on mixed (Relaxation & Trigger), testing on Trigger Module & Relaxation Module
4. **Mood-Aware Engagement Prediction**: Leave-One-Subject-Out methodology: Training on Relaxation Module & testing on Relaxation Module, Training of Trigger Module & Testing on Trigger Module
5. **Comparison of self-reported mood to automated mood**: 20-fold validation: Baseline is engagement prediction results without mood conditioning. Mood pre-conditioning performed with POMS self-reports & automated total mood disturbance estimates.

### Related Publications

1. S.Dhamija, T. Boult, *"Exploring contextual engagement for trauma-recovery"* DALCOM-W, CVPR 2017
2. S.Dhamija, T. Boult *"Automated Mood-aware Engagement Prediction"* ACII 2017

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