StressNet: Detecting Stress in Thermal Videos

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Introduction

- Stress is physiologically and psychologically damaging
- **StressNet** is the first approach that uses deep learning to estimate physiological signals and detect stress [1]

Motivation

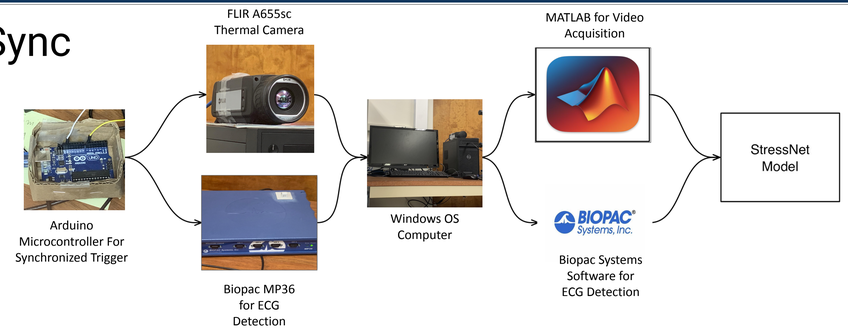
- Traditional stress detection is invasive and lacks automation
- Contactless health monitoring needed in the post-COVID world
- Can be used as a precursor to a more formal diagnosis

Data

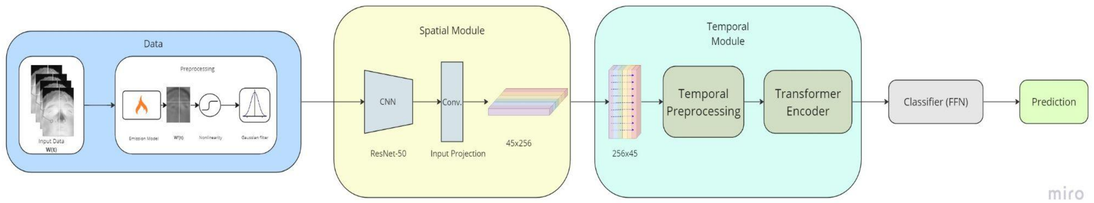
- Cold Pressor Test (CPT): Inducing physical stress by submerging hand or feet in ice water
- Original Data: BOSS Dataset recorded thermal videos, ECG and ICG signals of Subjects with feet in and out of ice water [2]
- New Data from UCSB IRB; approved experiments will not have ICG signal and do hand CPT

Method

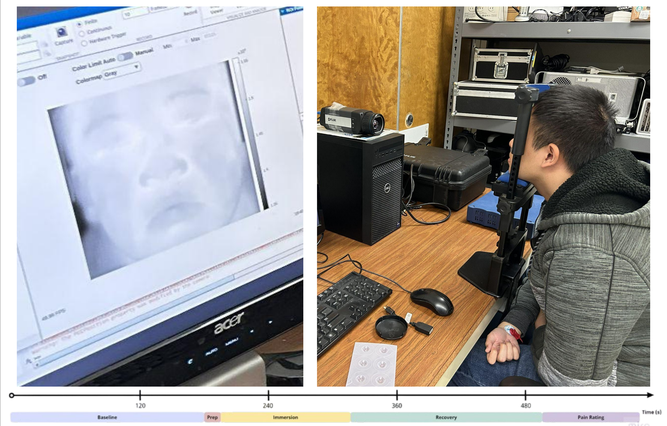
Data Sync



Network Architecture



Qualitative Results

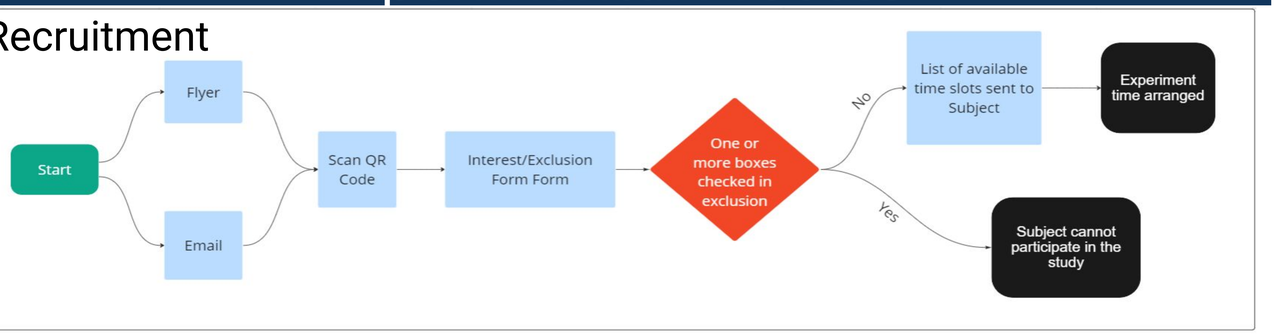


Conclusion

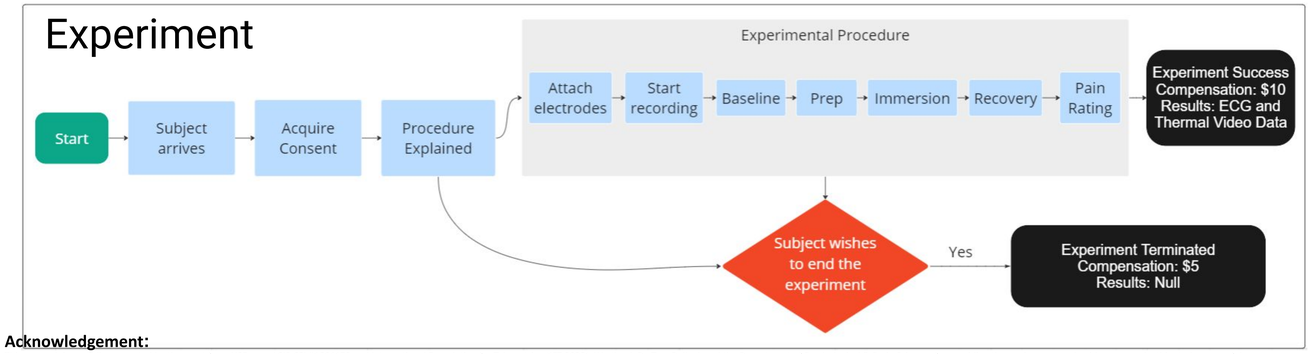
- StressNet can be used to facilitate wireless health monitoring
- Thermal dataset is highly unique and offers various applicability in future research
- Limitations of the model:
  - Noisy ECG signal due to poor electrode connection
  - Subjects move head out of field of view of camera

Experimental Process

Recruitment

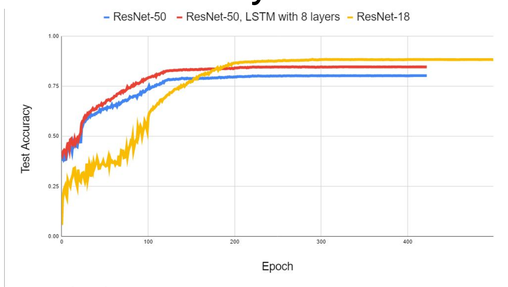


Experiment

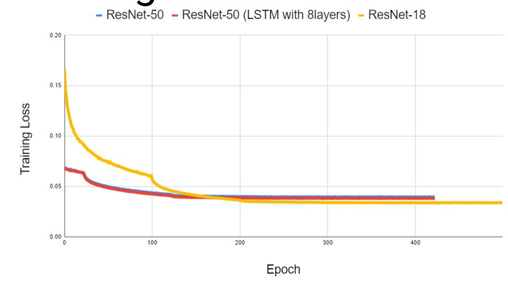


Performance

Test Accuracy

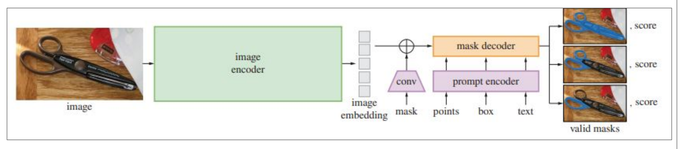


Training Loss



Potential Improvements

Segment Anything Model (SAM):
We are currently evaluating if SAM can be used to replace our spatial module [3]. SAM is a vision transformer that is better at learning long term dependencies than traditional models. However, we currently lack the necessary computing power to properly train the model.



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Reference:
[1] S. Kumar et al., "StressNet: Detecting Stress in Thermal Videos," 2021 IEEE Winter Conference on Applications of Computer Vision (WACV), Waikoloa, HI, USA, 2021, pp. 998-1008, doi: 10.1109/WACV48630.2021.00104.
[2] Bullock T, MacLean MH, Santander T, Boone AP, Babenko V, Dundon NM, Stuber A, Jimmons L, Raymer J, Okafor GN, Miller MB, Giesbrecht B and Grafton ST (2023) Habituation of the stress response multiplex to repeated cold pressor exposure. *Front. Physiol.* 13:752900.
[3] A. Kirillov *et al.*, 'Segment Anything', *arXiv [cs.CV]*. 2023.