SaTC: CORE: Medium: Collaborative: Presentation-Attack-Robust Biometrics Systems via Computational Imaging of Physiology and Materials (1801435, 1801372, 1801382)

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Example of spoofing attacks.

Objective: Build end-to-end biometric systems based on face and iris that integrate computational imaging sensors for acquiring physiological, spectral and material properties which will be used to detect and mitigate the effects of known and unknown PAs.

Motivation:

- The vast majority of literature in presentation attack detection (PAD) is based on liveness detection techniques (i.e. systems which aim to detect signs of life) using off-the-shelf (OTS) video cameras.
- Since it is inherently more difficult to spoof multiple modalities and systems simultaneously, multimodal biometrics systems have also been proposed in the literature for PADs. Even in these systems PAs remain a serious cause of concern, as many biometric systems remain vulnerable to the simplest forms of spoofing attack.
- Existing approaches remain fundamentally limited to liveness detection, with some limited work in the use of multispectral cameras for material identification.

Technical Approach:

- Build computational cameras that augment traditional sensors used for face and iris recognition by measuring changes in a subject's physiology including vital signs, blood perfusion, voluntary and involuntary responses to external stimuli as well as material properties in scattering, reflectance, and spectral profiles.
- The signatures sensed by our computational cameras will provide a robust characterization of the true biometric and its variations while providing high discriminability to commonly used PAs.
- Develop a highly flexible approach for detecting previously unseen PAs based on outlier detection and open-set modeling.
- Test and validate by building two imaging systems - one each of face and iris recognition and PAD - that bring together the advances made in both computational imaging and biometric components.

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Outreach and Broader Impacts Plan:

- Participate in minority recruitment for the School of Engineering @JHU.
- Outreach activities that engage young potential engineers and computer scientists including middle school and highschool students via imaging workshops.
- Integrate biometrics lectures to existing machine learning and computer vision courses.
- Write articles, accessible to the layman, of a non-technical nature that will highlight the risks and benefits associated with widespread adoption of biometrics for authentication and the risks in their theft.

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