Interview Notes:

Rolling Reality: Leveraging Rolling Shutter Effects in Photography for

Privacy-Protected Human-Computer Interfaces

**Lead Researcher:** Dr. Xiao Zhang

**Contact:** [zhanxiao@umich.edu](mailto:zhanxiao@umich.edu)

**Phone:** 517-303-5684

**Office:** Room 212, CIS @ 1:00 pm - 4:00 pm Thursday; or by appointment.

**Personal Website:** <https://www.zhangxiao.me/#home>

**Project Proposal:** <https://mediasite-cecs.umd.umich.edu/Mediasite/Play/0c5469b3fc4e43f98f48284f2ee8972b1d>

### **Overview:**

Develop software (mobile app) capable of analyzing real-time footage from rolling shutter cameras to 'stabilize' and smooth finger gestures, particularly for handwriting. This project leverages the rolling shutter effect common in modern smartphone cameras, using image processing techniques to track and reconstruct finger movements in 3D space. The goal is to make gestures or writing clearer and more easily interpretable by compensating for rolling shutter distortions.

The project will use hardware, such as LED gloves, in combination with smartphone cameras and a mobile app to achieve gesture tracking and 3D visualization. This will involve processing rolling shutter frames to map and smooth the gestures for improved usability and accuracy in future applications.

### **Mobile App Workflow:**

1. **Capture rolling shutter footage** of hand gestures using the phone's camera.
2. **Track the movement of the finger** across consecutive frames to identify its path.
3. **Reconstruct the finger's movement** into a continuously updating 3D space, compensating for distortions caused by the rolling shutter effect.
4. **Create a 3D representation of the gestures** to ensure compatibility with future features and applications.
5. **Apply smoothing techniques** to refine the gesture path and improve the clarity of gestures or handwriting. This can be achieved using either traditional image processing algorithms or machine learning models trained to recognize and predict smoother patterns in motion.

### **Key Steps for the Software:**

1. Analyze rolling shutter frames to extract gesture data.
2. Detect and track finger movements in real-time using LED gloves for enhanced accuracy.
3. Rebuild finger paths in 3D space, compensating for motion distortions caused by the rolling shutter.
4. Implement smoothing techniques to refine the gesture flow for more readable results.
5. Maintain future compatibility by storing gesture data in a flexible 3D format.