

Fringer: A Finger-Worn Passive Device Enabling Computer Vision Based Force Sensing Using Moiré Fringes

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Overview

A non-active sensing method for pressing force using computer vision techniques and Moiré Fringes.

Motivations: to conveniently detect subtle force changes under fingertip during interactions with daily objects and devices

Advantages: non-intrusive, calibration free, controllable sensing range, work with normal digital camera in different light conditions

Equations:

$$(1) T_M = \frac{T_A T_B}{T_A - T_B} \quad (2) \Delta_B = \Delta_M \frac{T_A - T_B}{T_A} \quad (3) F = k \Delta_B$$

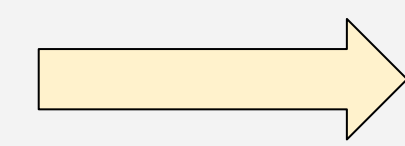
Equation 1, 2 are from Xiao, C., & Zheng, C. MoiréBoard: A stable, accurate and low-cost camera tracking method. *UIST'21*



Image Processing



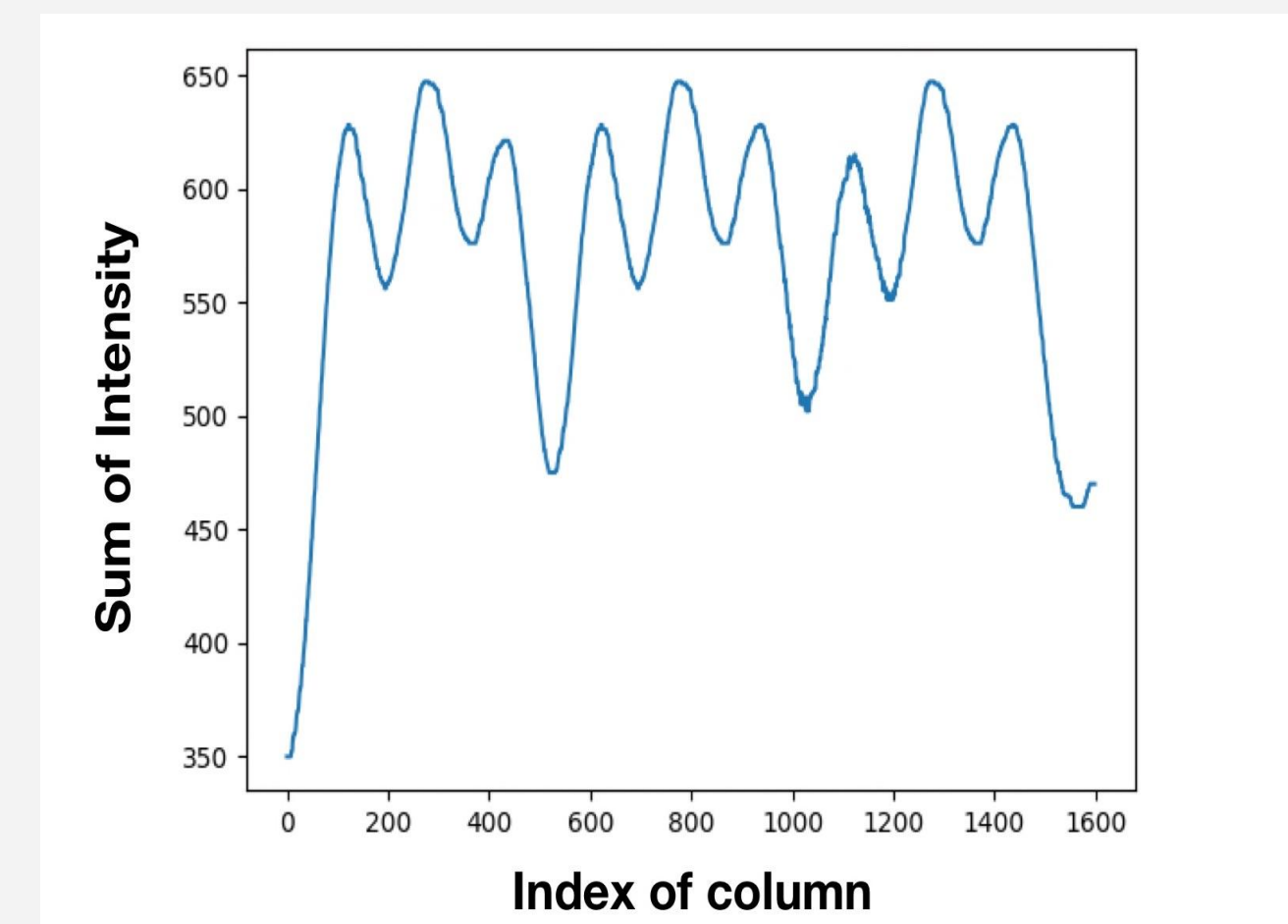
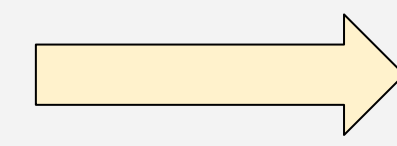
Concatenation



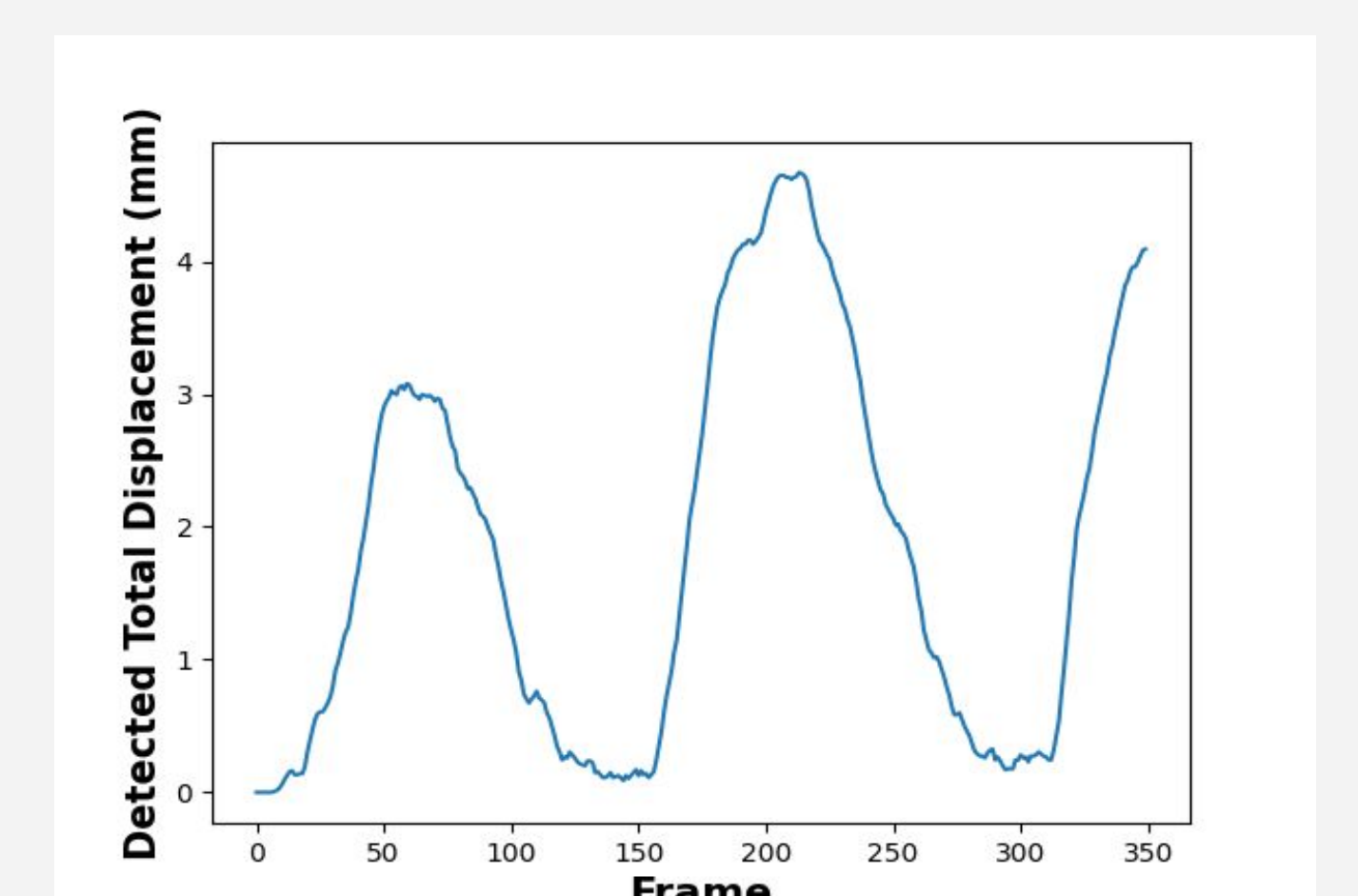
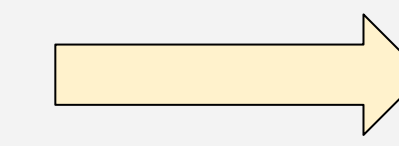
Gaussian Blur



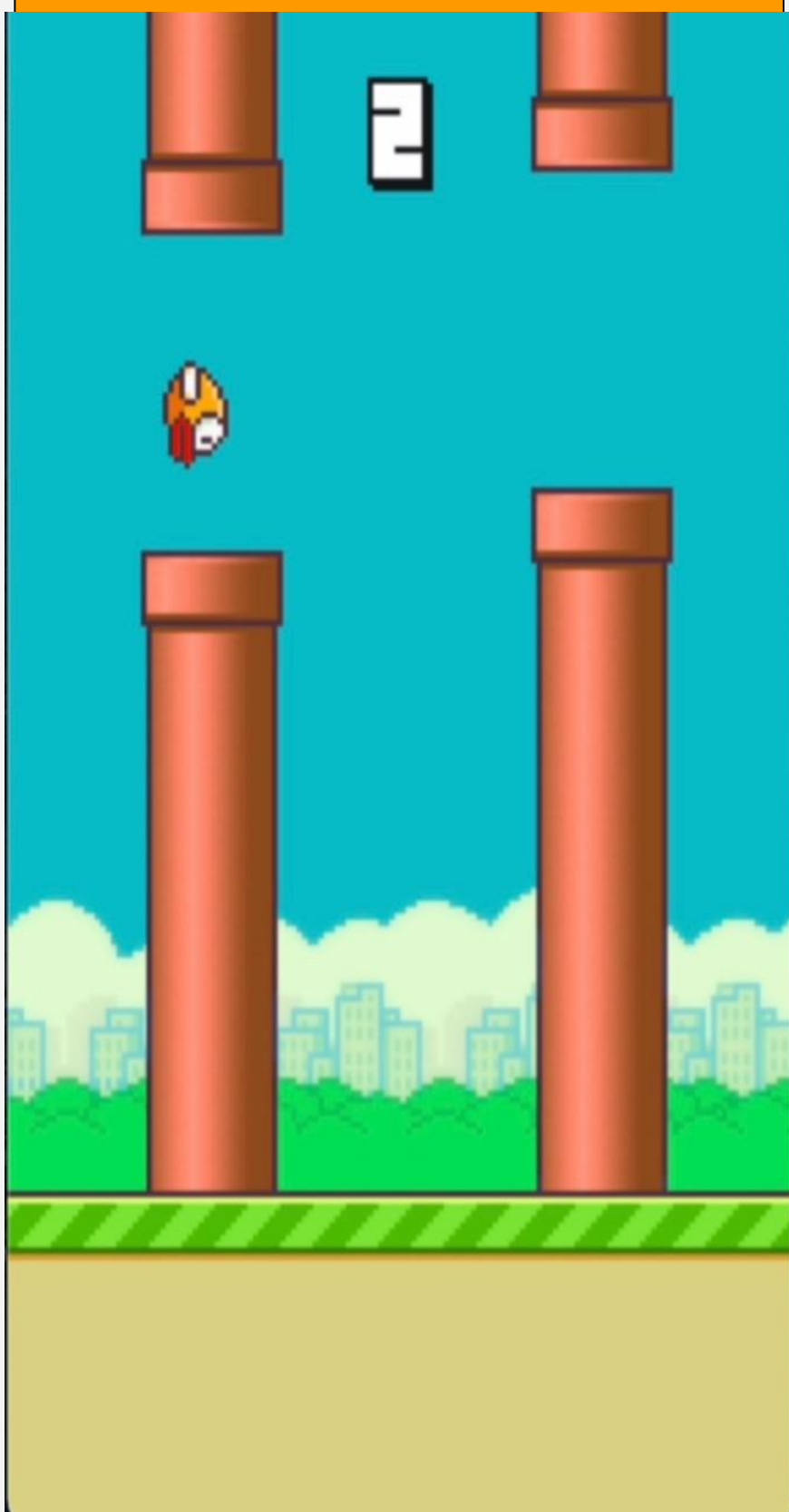
Fringe Detection



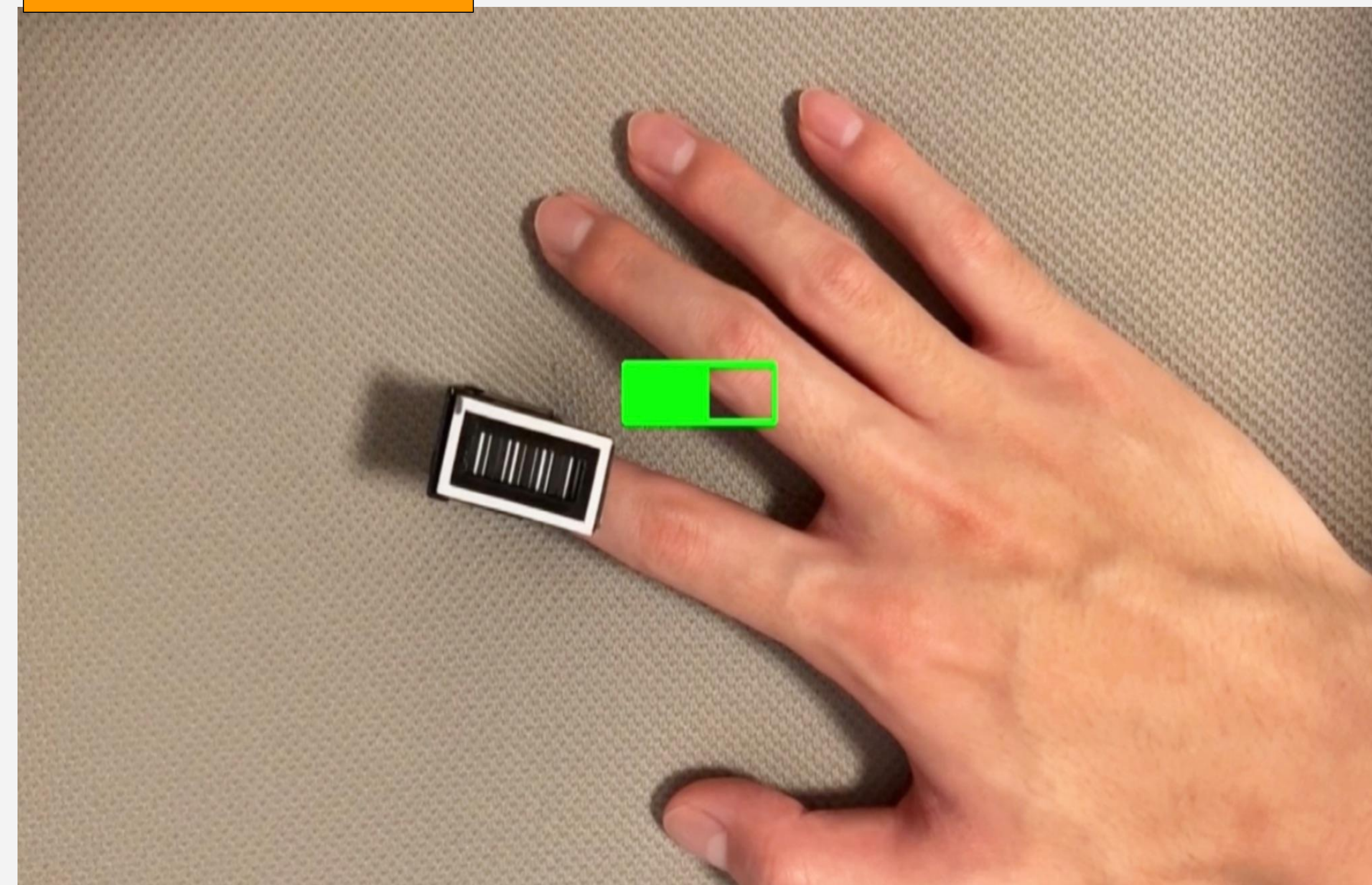
Displacement Tracking



Application: Flappy Bird

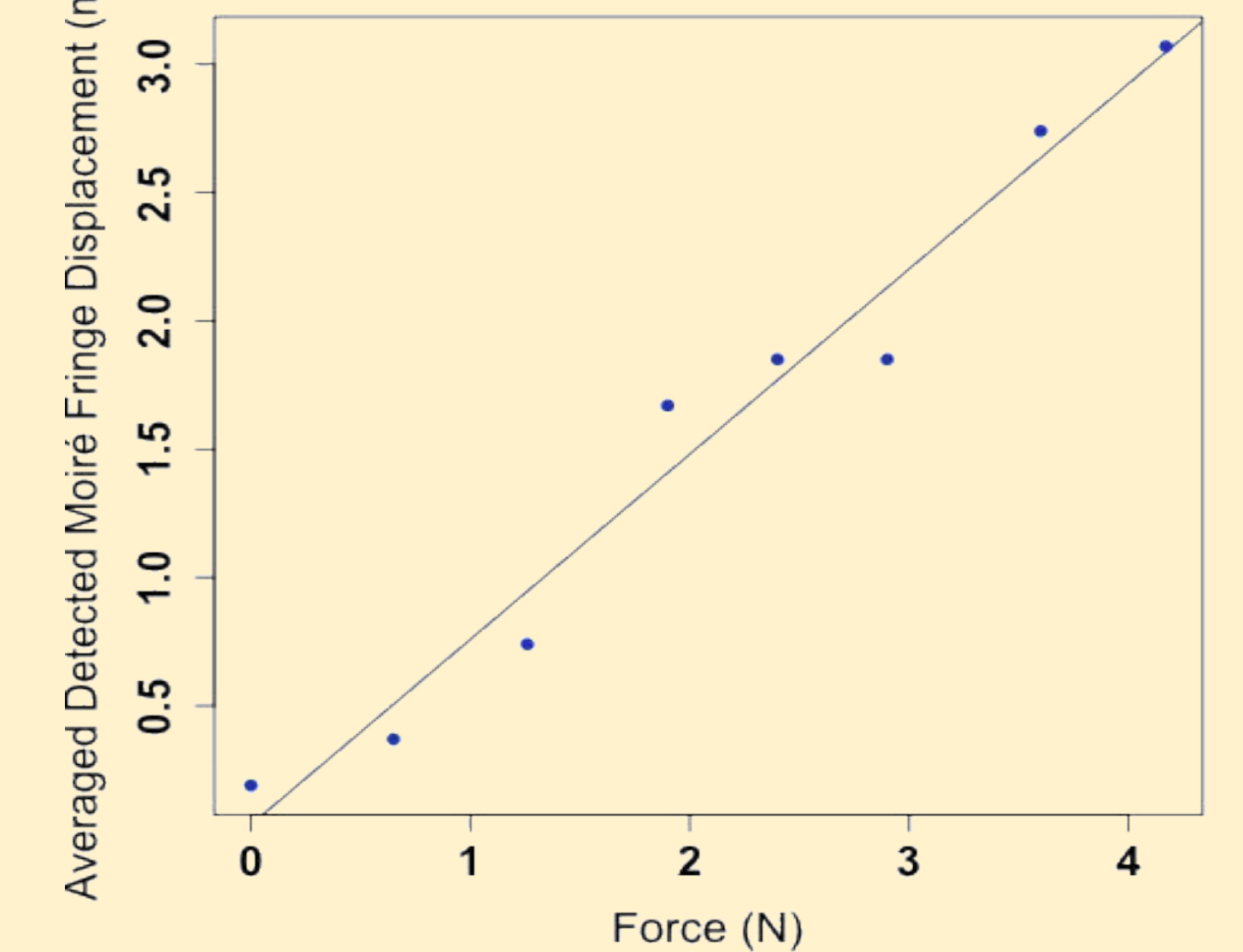


Application: Force Visualizer



Evaluation & Future Goal

Simple Linear Regression of Pixel Displacement on Force $r^2=0.9681$



Future Goals:

- Image processing pipeline that is more resistant to noise
- Support multi-fingers detection
- Exploring usability and utility in more scenarios