

Barrett Honors Thesis

iLieDown: Improved Display Orientation for Handheld Devices Using Convolutional Neural Networks

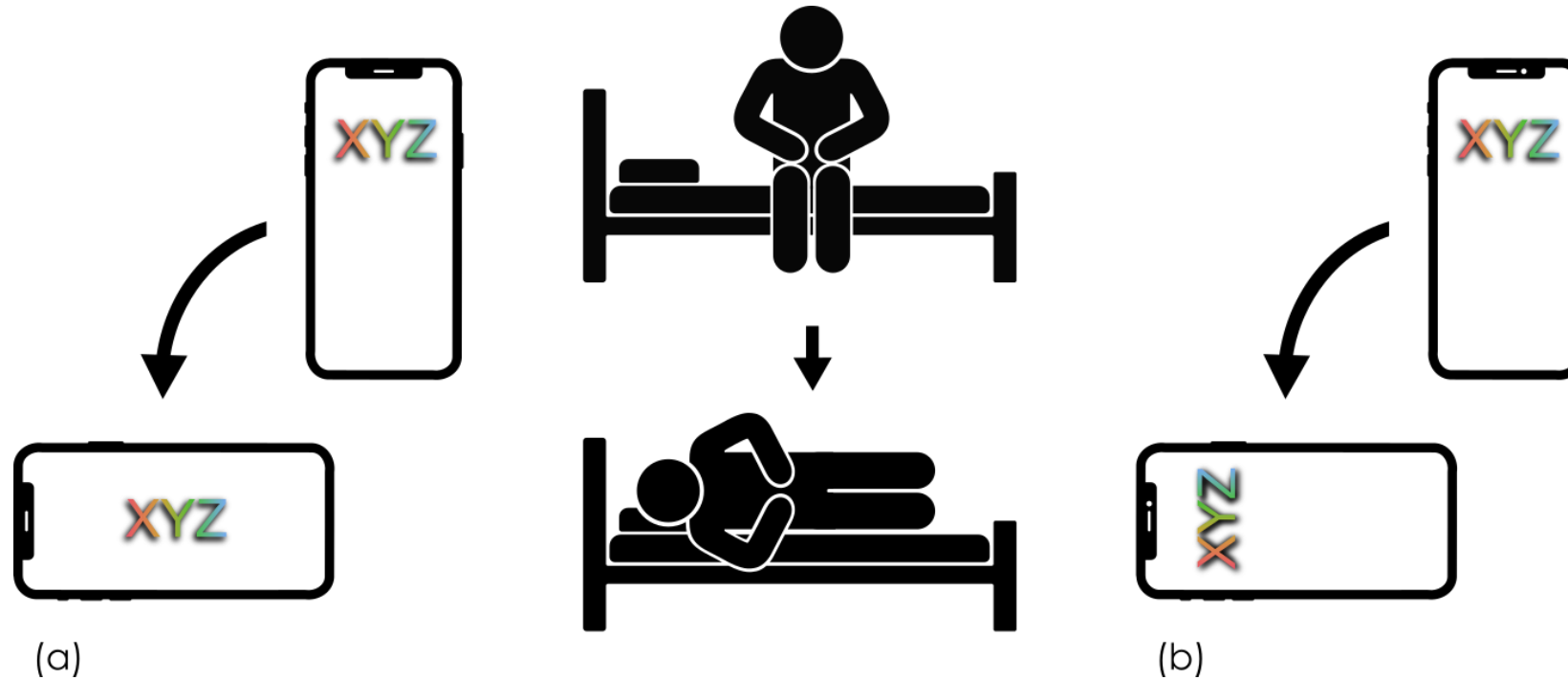
Riley Tallman
rtallman@asu.edu

Professor
Yezhou Yang
yz.yang@asu.edu

Zhiyuan Fang
zfang29@asu.edu

Part I: **The Problem**

A user lies down...



Correct vs Incorrect Rotation. The user lies down and the screen rotates incorrectly in (a), but correctly in (b).

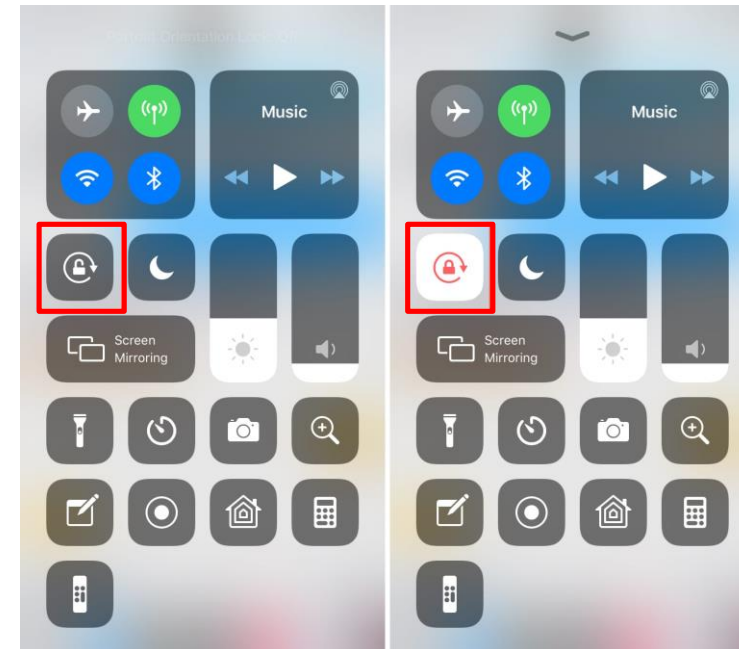
91% of users
experience incorrect
autorotation [1].

Current Solution

Manual Orientation Lock



Physical switch



Software switch

27% of users are
unaware of rotation
lock [1].

Part II: Our Solution: **iLieDown**

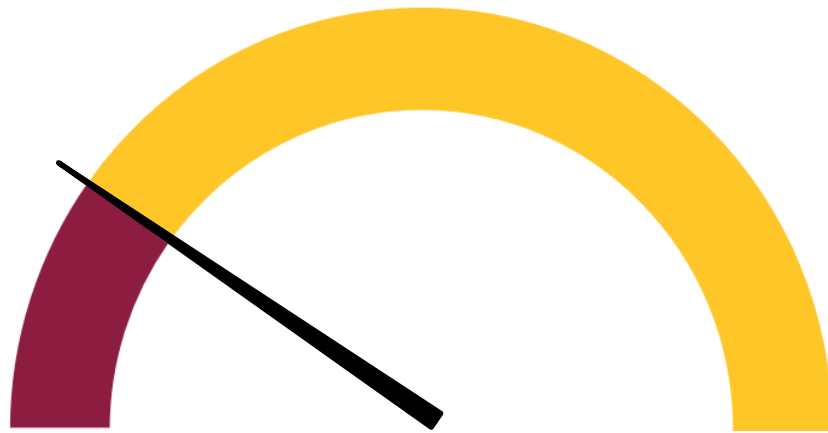
iLieDown

The user's face will always show the correct orientation

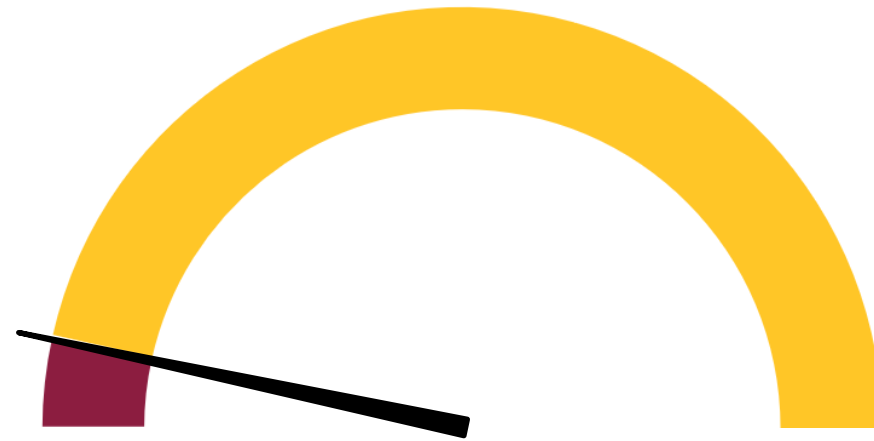
- 1. Capture images**
- 2. Analyze**
- 3. Orient**
- 4. Constantly repeat?**

iLieDown

CPU utilization during CNN* analysis at **30FPS**



20%
iPhone 6

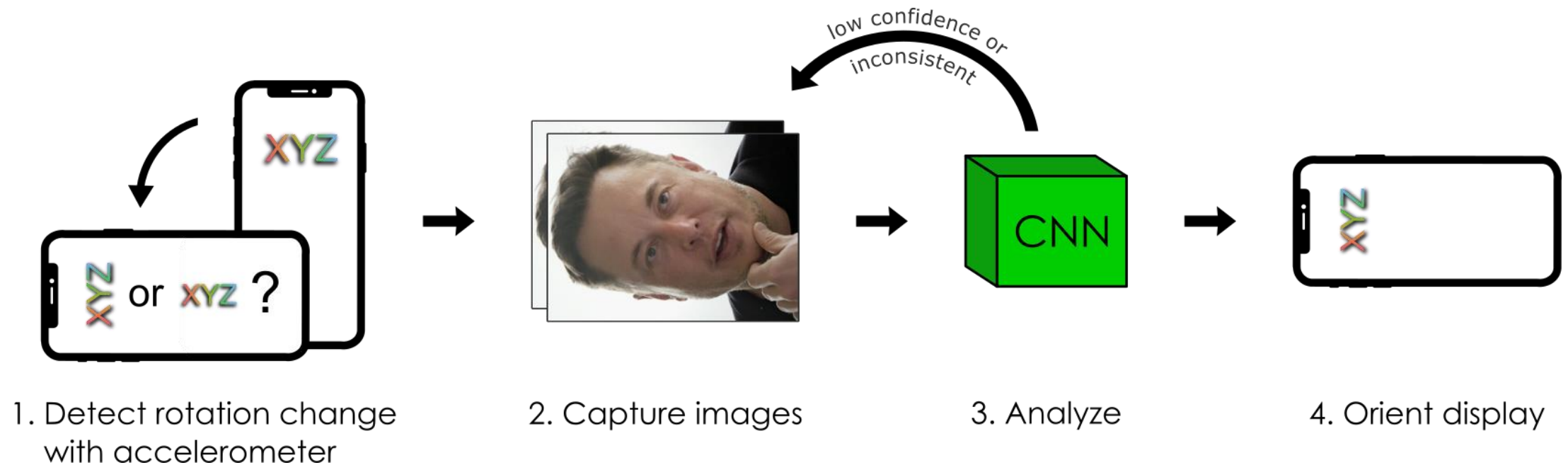


7%
iPhone XS

**CNN with 23,090 parameters*

iLieDown

Efficient solution



Max CPU usage to analyze 8 images of 7.5% and 2.2% on iPhone 6 and XS respectively

Part III: Experiments

Feasibility Test

Does it work?

- 20 users were tested in different environments and lighting conditions with an iPhone 6
- Users were unaware of the application and given a reading task to simulate real-world device use
- Various backgrounds and lighting conditions

61% Success Rate

- 6x improvement over previous solution [1]

Privacy Survey

Camera access required

- If iLieDown was a feature integrated into the OS, it would take pictures every time the device was rotated.

100% Would use it

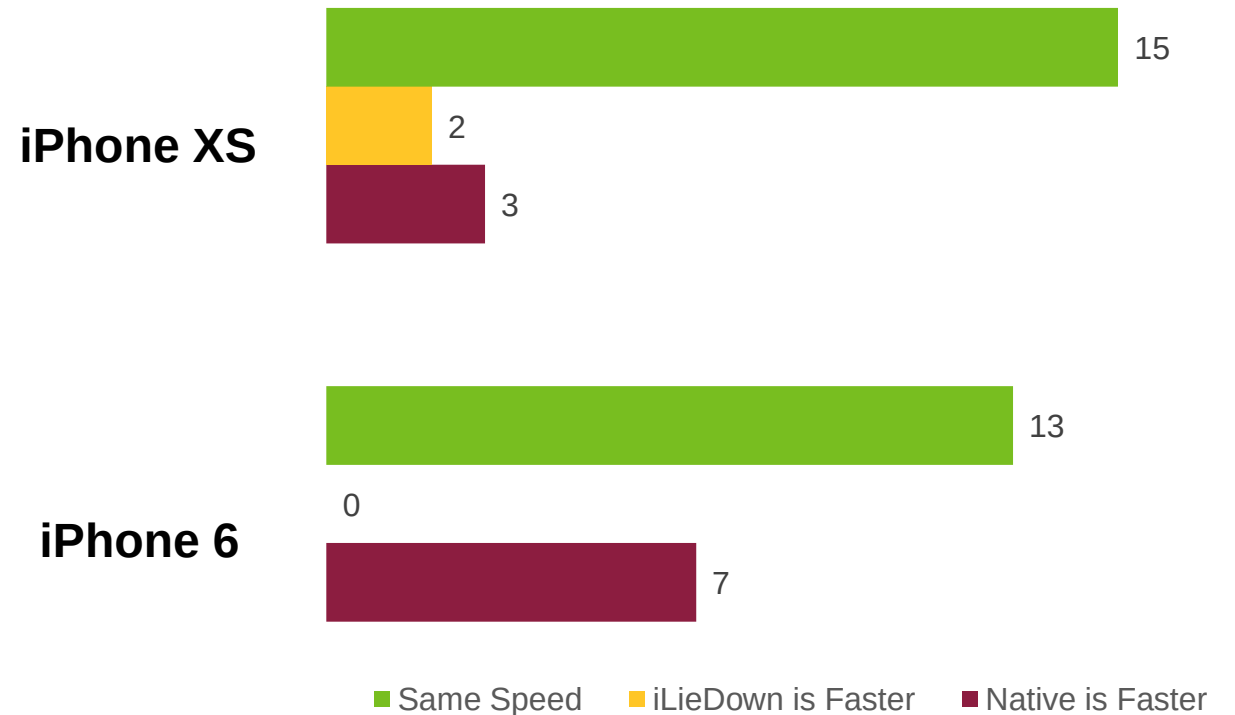
- 2 users said only if the company was reputable

50% (10 users) were okay with anonymous collection of images

Noticeable Lag Test

- Users were given native orientation and iLieDown and asked to determine if one was faster than the other

**70% Reported
Same Speed**



iLieDown Demonstration

- <https://www.youtube.com/watch?v=qw4E42ZwFK4>

Thank you

<https://rptallman.github.io/portfolio/>

1. Cheng, Lung-Pan, Fang-I. Hsiao, Yen-Ting Liu, and Mike Y. Chen. "iRotate: automatic screen rotation based on face orientation." In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 2203-2210. ACM, 2012.