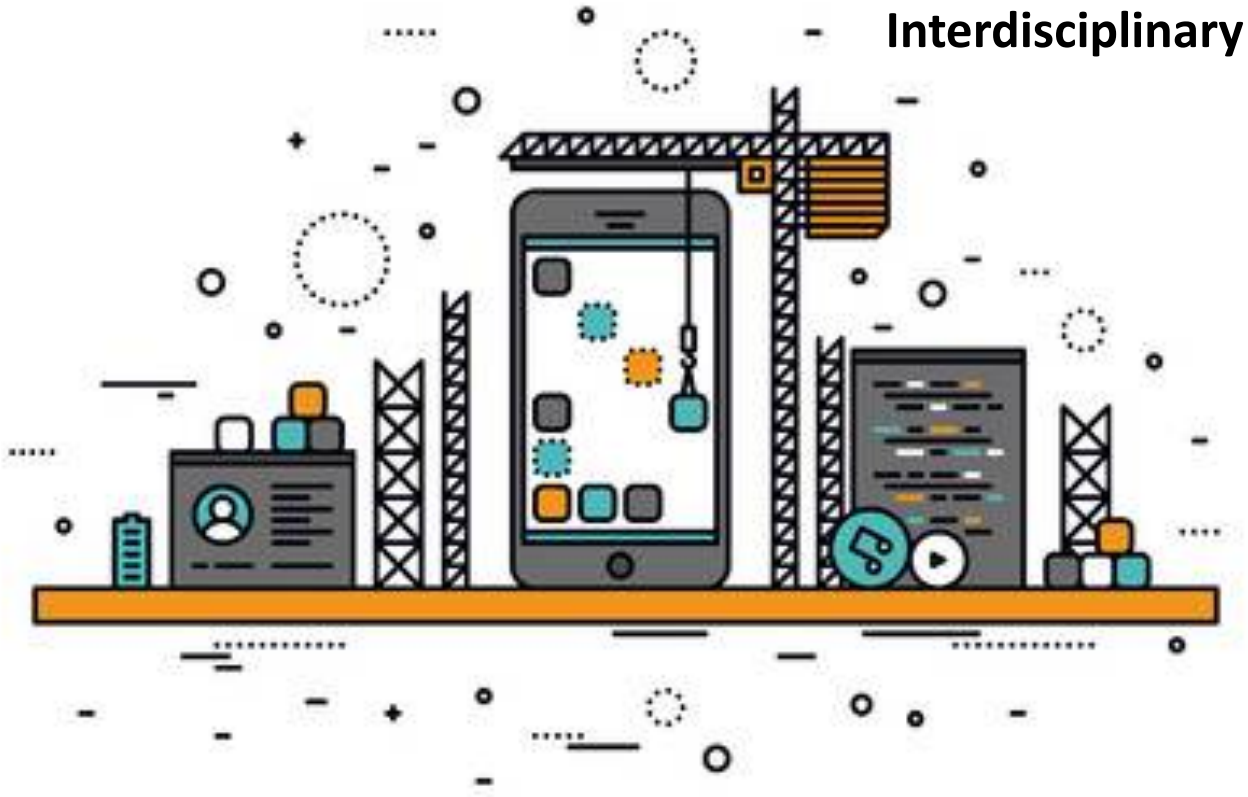
Android application development for processing the output data of computer vision and machine learning techniques for segmentation of geometrical primitives on RGB images



Interdisciplinary Project

20.09.2018

Presented by

Juan Du

Bilal Ahmed

KEWAZO

Introduction

User-Centered Product

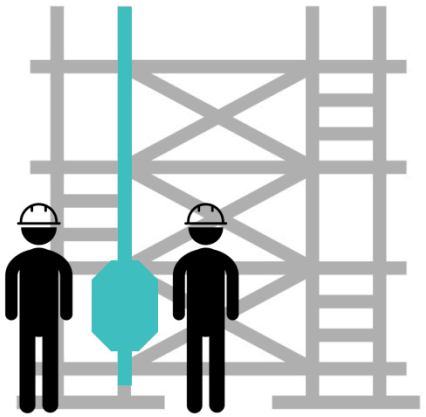
Task Flow

Algorithm

Interface

Q&A

Introduction



KEWAZO: Smart robotic scaffolding transportation system

Problem

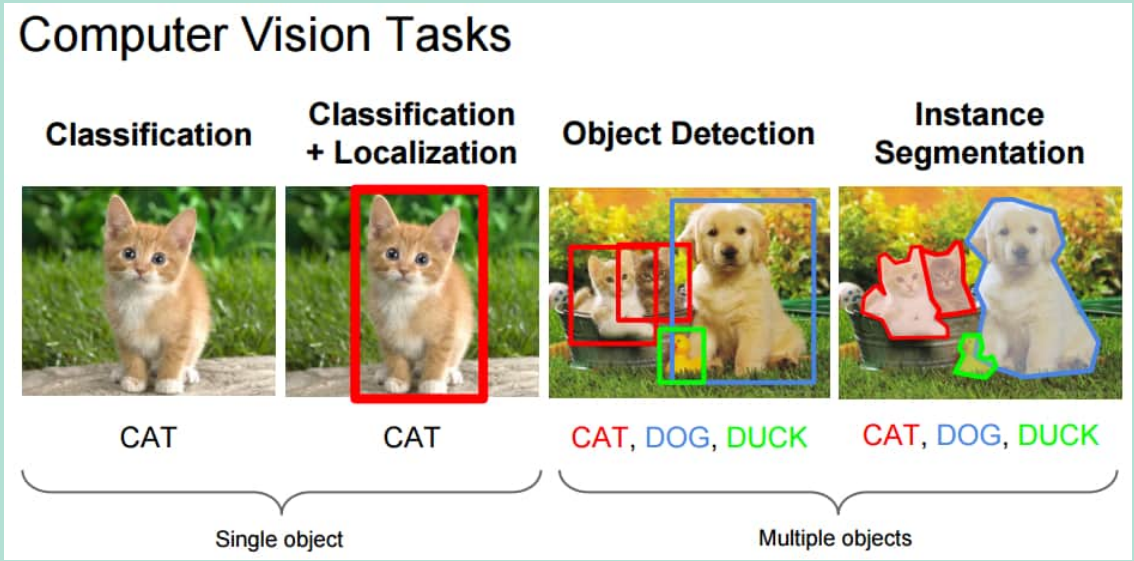
Solution

Problem

- During the preparation, it is important to know the **number** and **type** of scaffolding parts located in the storage space

Solution

- Computer Vision
  - Fast development, efficient
- Smartphone Application
  - Computing power, convenient



User-Centered Design

- Development proceeds with the user as the center of focus
- Increase product usefulness and usability

Task Flow

Algorithm

Interface

Task Flow: Iterative Model

- Adaptable to the ever changing needs
- Frequent user feedback

User-Centered Design

- Development proceeds with the user as the center of focus
- Increase product usefulness and usability

Task Flow

Algorithm

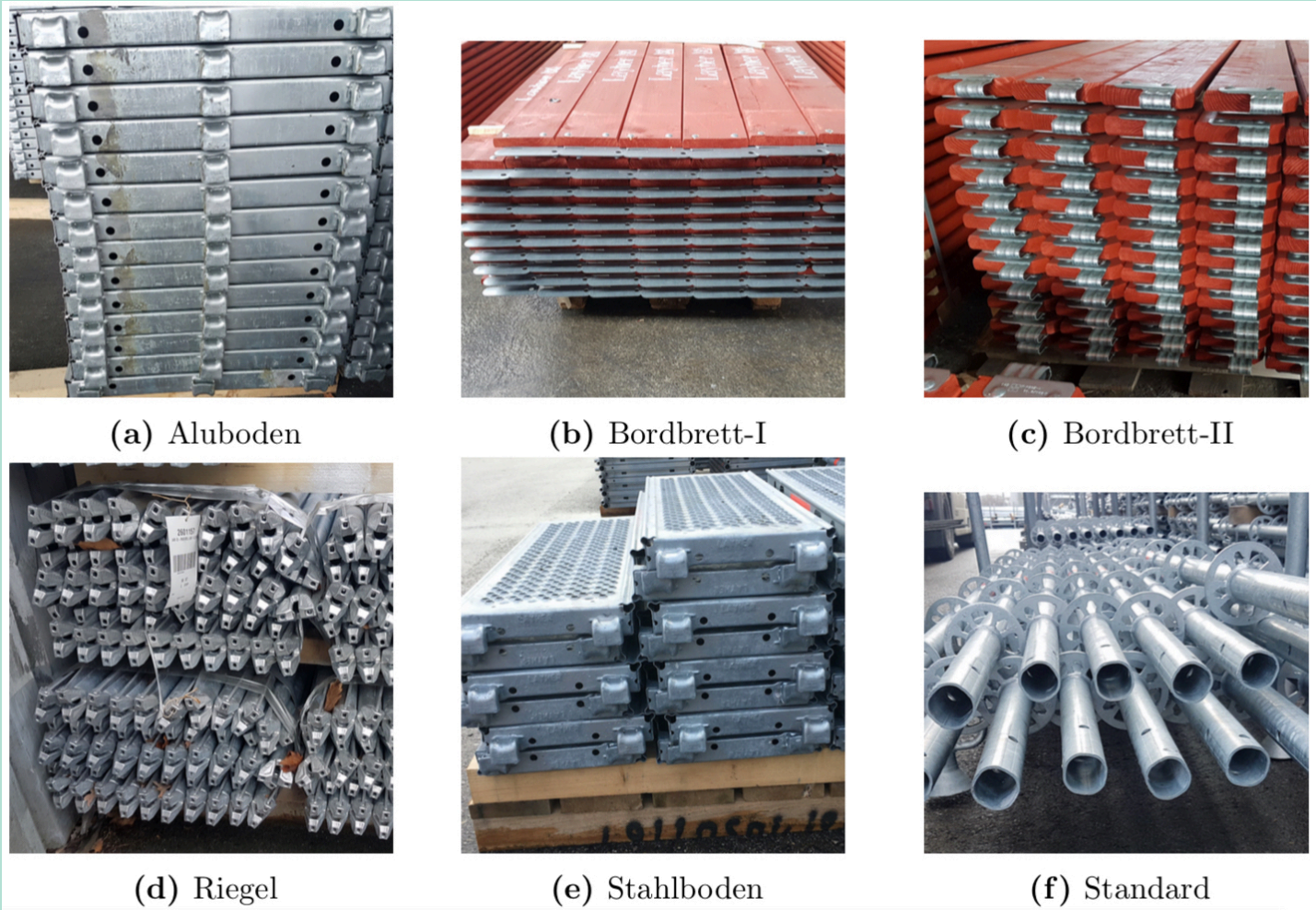
Interface

CV Algorithm

- The most suitable algorithm
  - Core Requirements ?
    - Accuracy
    - Speed
  - Dataset Feature?
  - Extreme Environments?

Dataset

- Generality :
  Apply the same algorithm for multiple types of objects



(a) Aluboden (b) Bordbrett-I (c) Bordbrett-II

(d) Riegel (e) Stahlboden (f) Standard

CV Algorithm

- The most suitable algorithm
  - Core Requirements ?
    - Accuracy
    - Speed
  - Dataset Feature?
    - Generality
  - Extreme Environments?

Extreme Environments

- Robustness
  - Viewpoint
  - Light
  - Quantity

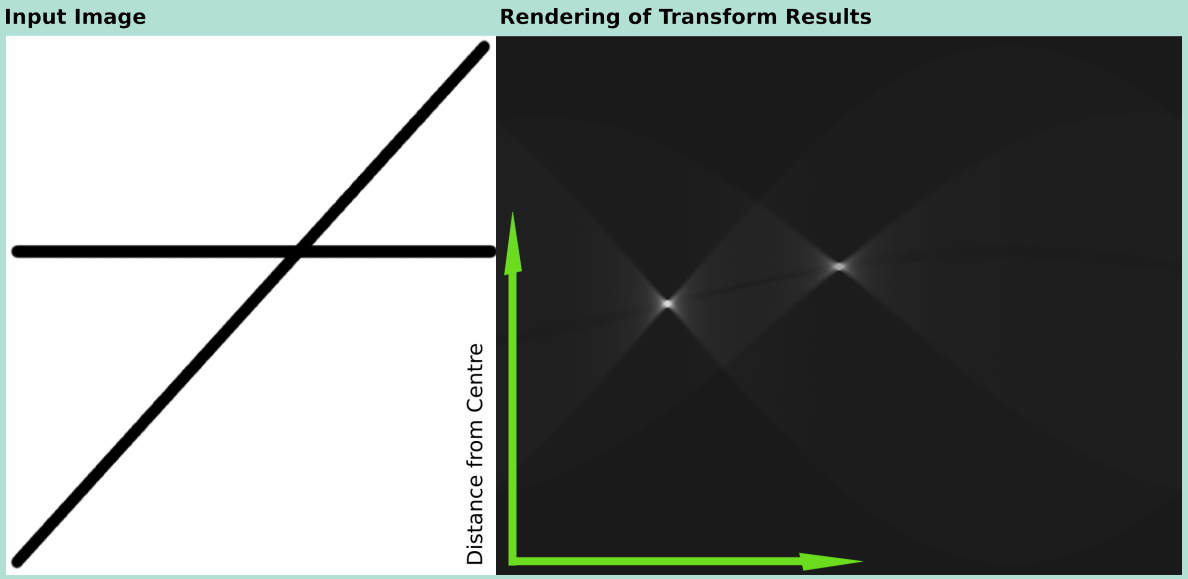
CV Algorithm

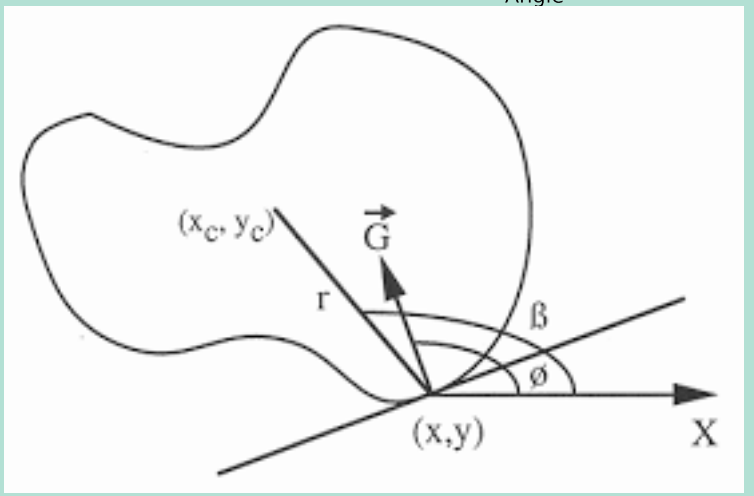
- The most suitable algorithm
  - Core Requirements ?
    - Accuracy
    - Speed
  - Dataset Feature?
    - Generality
  - Extreme Environments?
    - Robustness

CV Algorithm

- Generalized Hough Transform (GHT)
  - ✓Fast
  - ✓Arbitrary shapes
  - ✓Robust

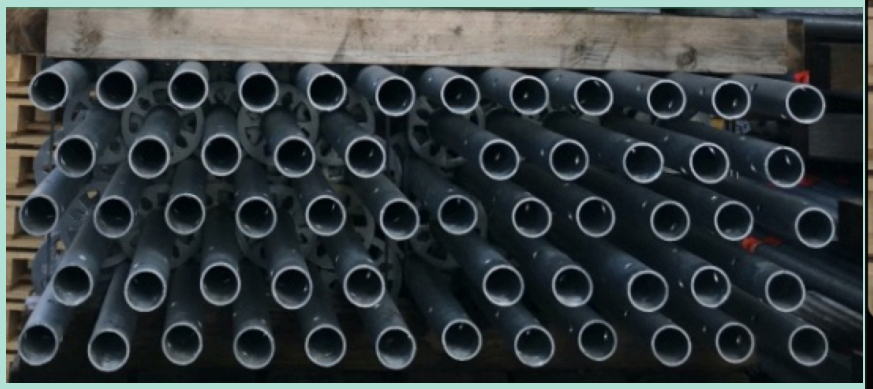
- Pre-process and Post-process
  - ✓More accurate
  - ✓Robust

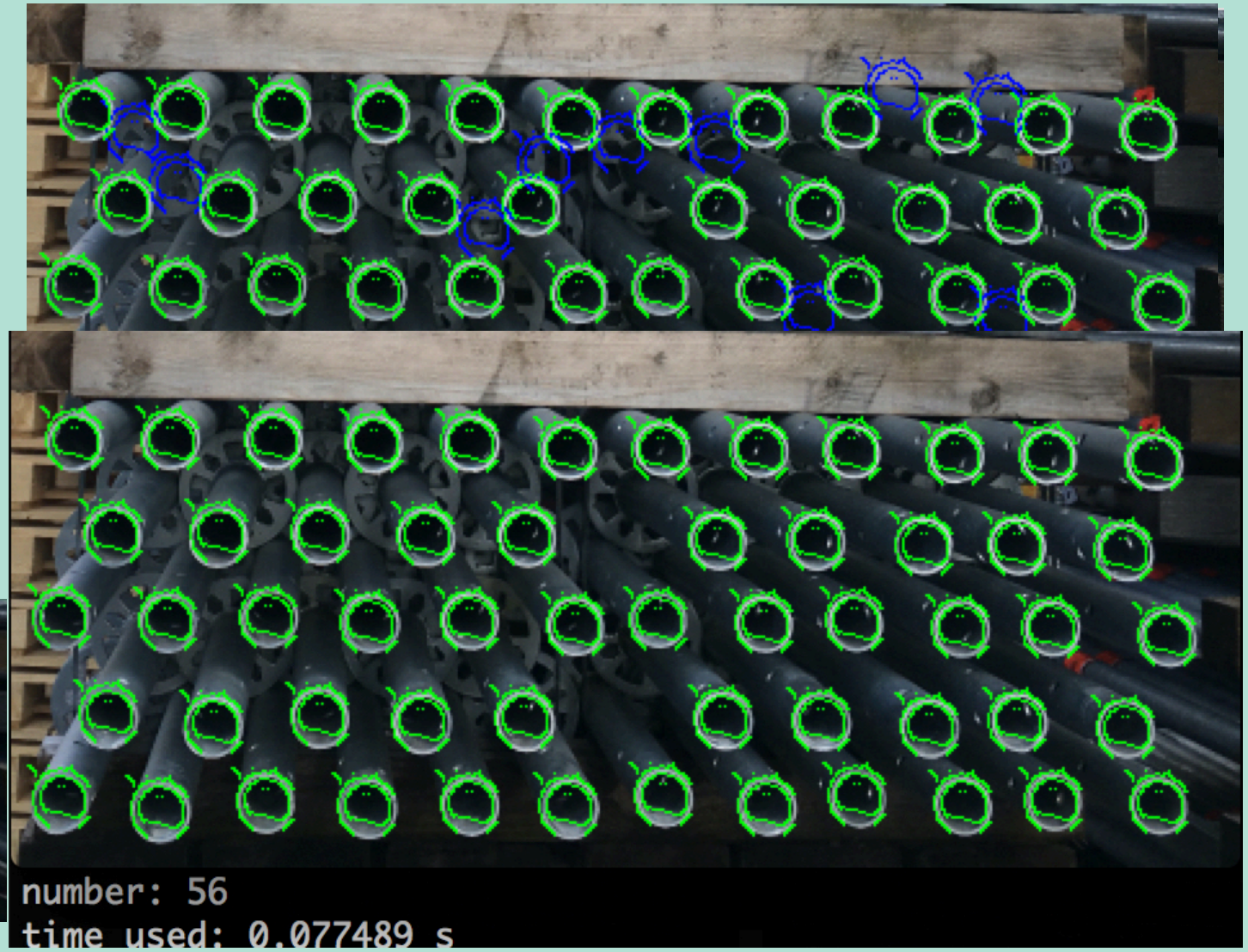




CV Algorithm: Overall Process

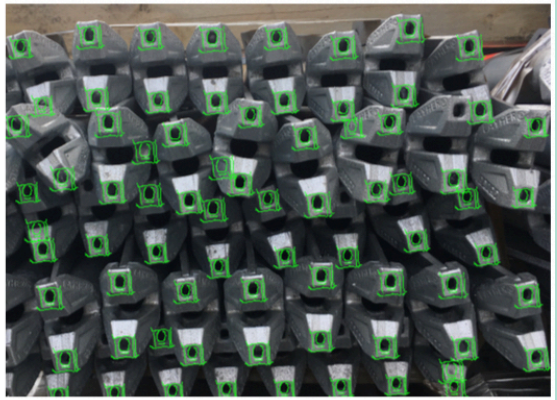
- Input image ⬅
- Choose template ⬅
- Pre-process ⬅
- Apply GHT algorithm ⬅
- Post-process ⬅
- Final result ⬅



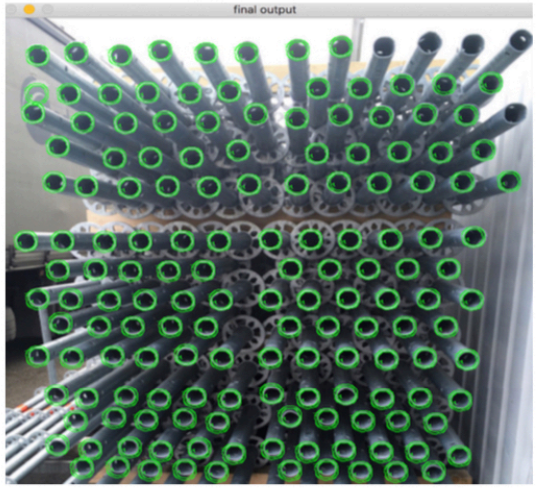


CV Algorithm: More Results

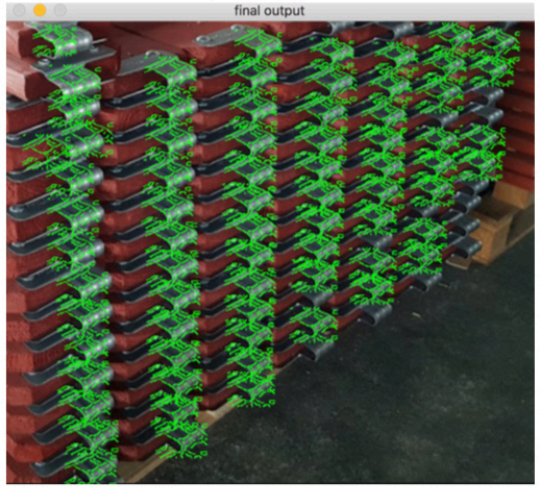
(a) Aluboden



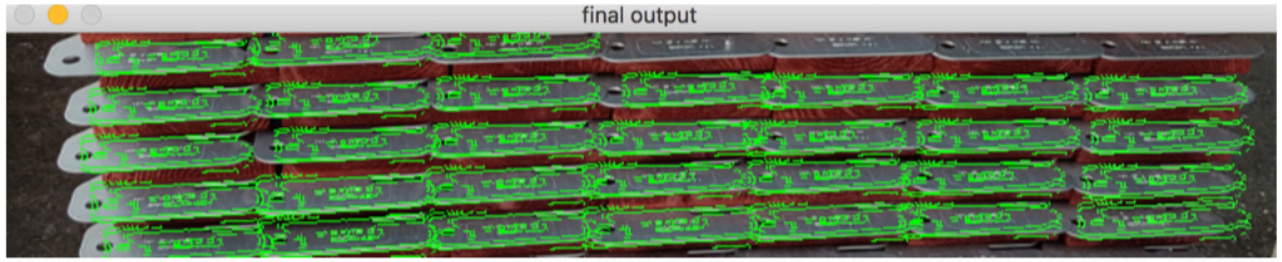
(b) Riegel



(c) Standard



(d) Bordbrett-II



(e) Bordbrett-I

(f) Stahlboden

Objects	result / true number
Aluboden	24 / 24
Riegel	34 / 32
Standard	152 / 156
Bordbrett-II	81 / 86
Bordbrett-I	31 / 35
Stahlboden	38 / 38

(g) Accuracy

User-Centered Design

- Development proceeds with the user as the center of focus
- Increase product usefulness and usability

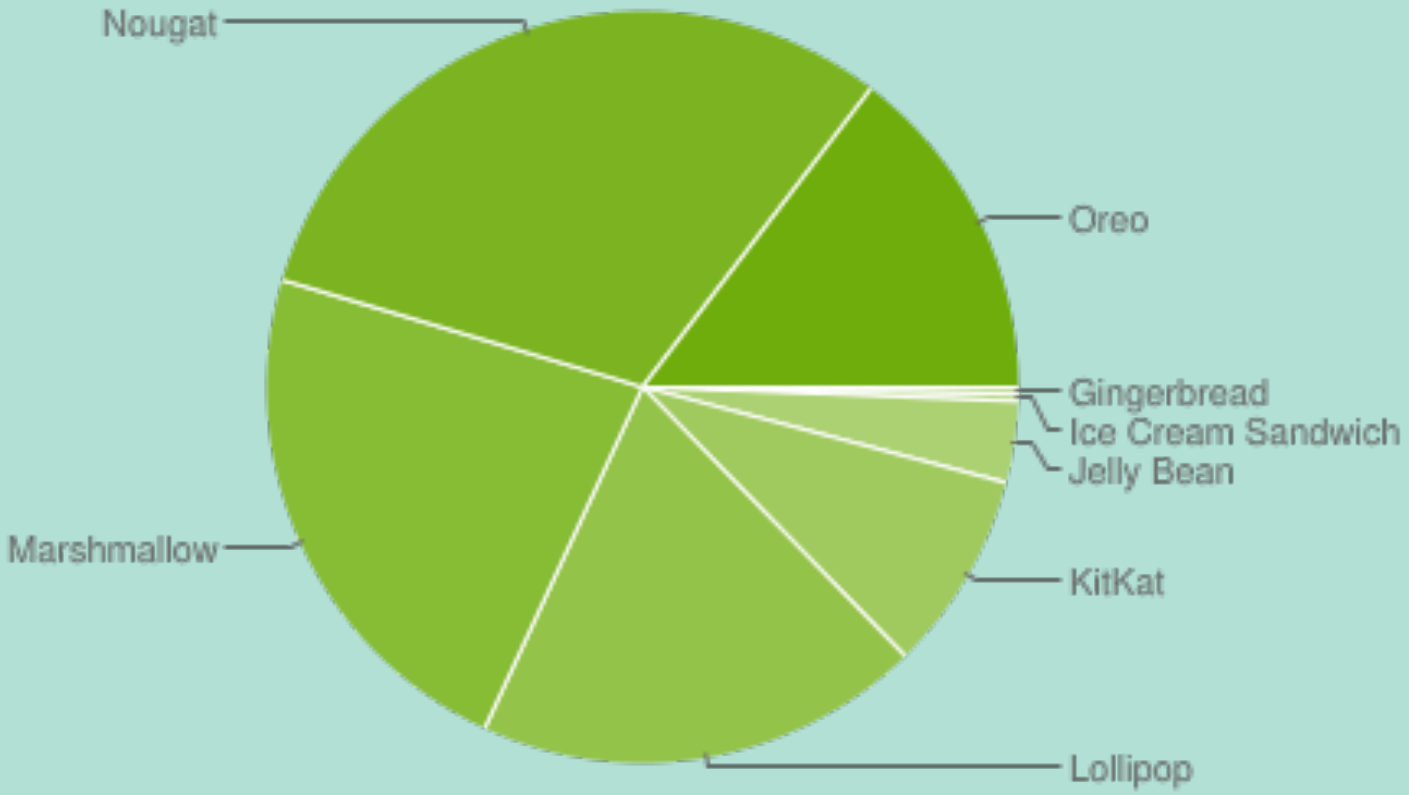
Task Flow

Algorithm

Interface

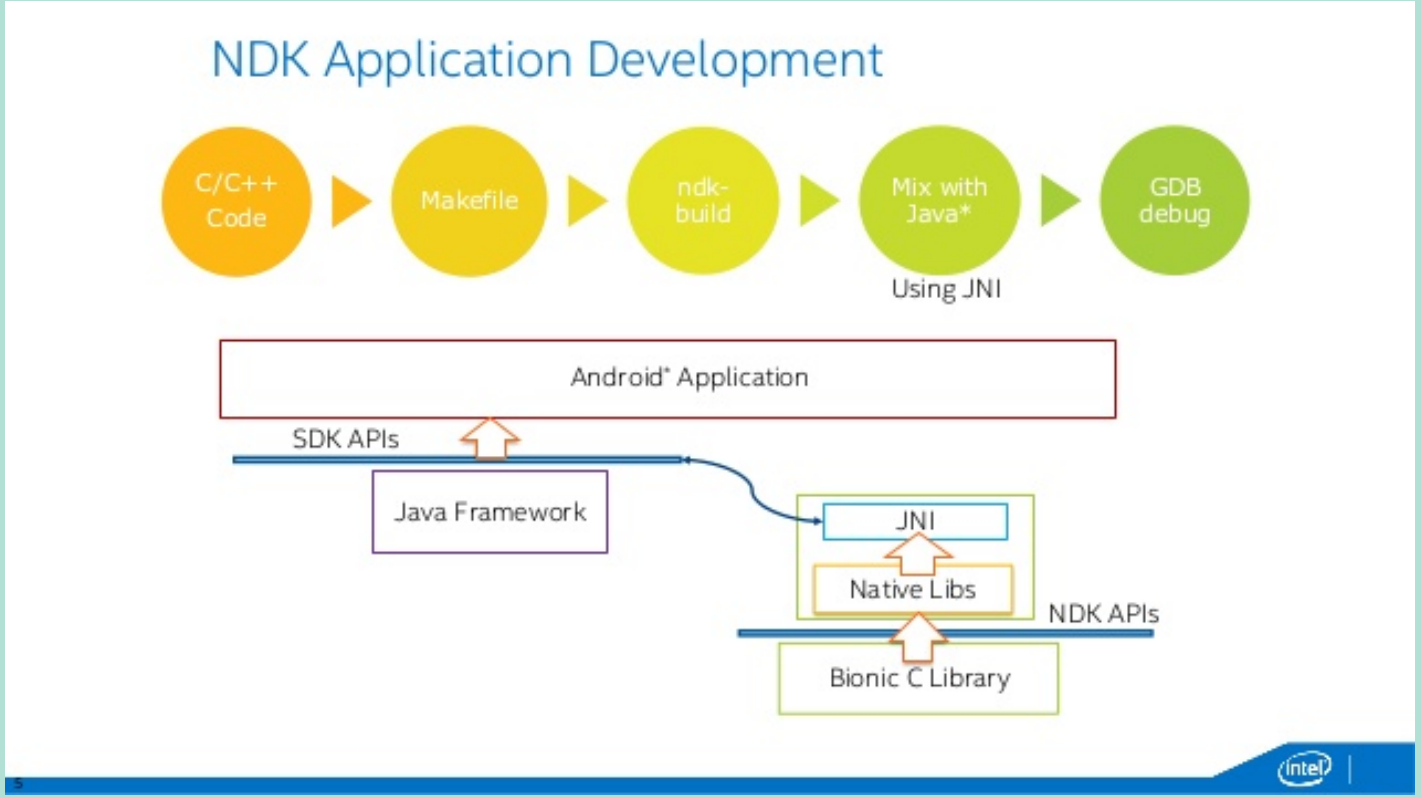
Mobile App

- Our CV algorithm should be implemented in an app
- Android or iOS?
- What do our clients use?
- Which version of Android?
- Maximum market share



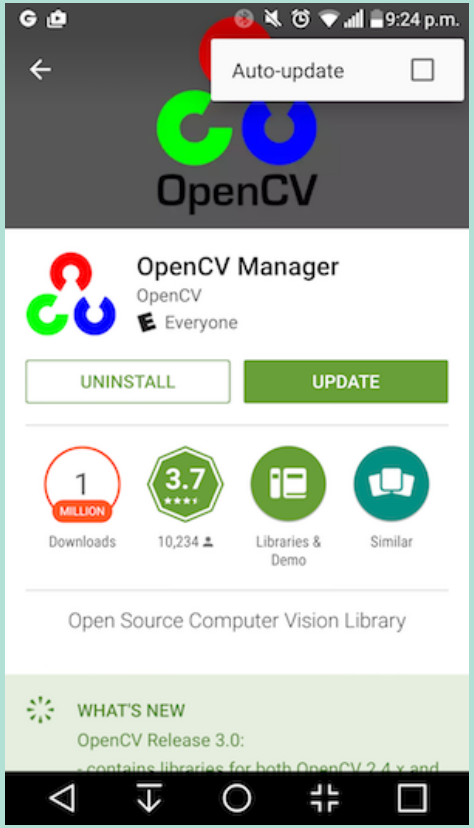
JNI Framework (Java Native Interface)

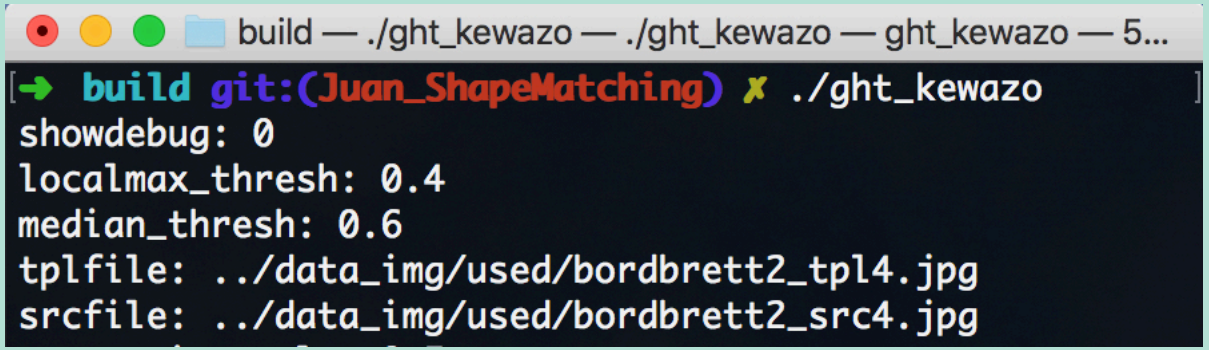
- CV algorithm written in C++
- C++ is a speedy language
- Performance constraints
- Android apps written in Java
- Incompatible
- JNI functions written to bridge the gap



Making intuitive app

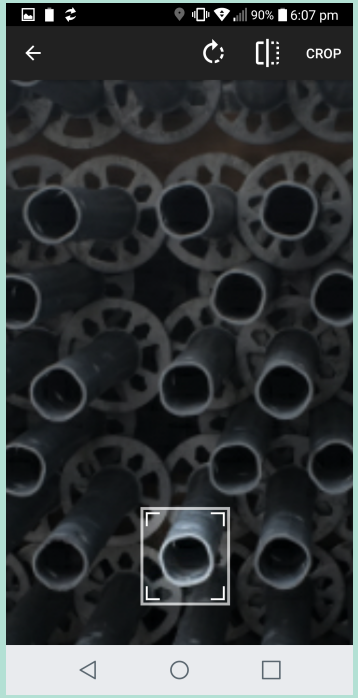
- Goal to make user friendly app
- Algorithm requires user inputs through command line
- Algorithm requires dependencies to be installed
- Solutions?





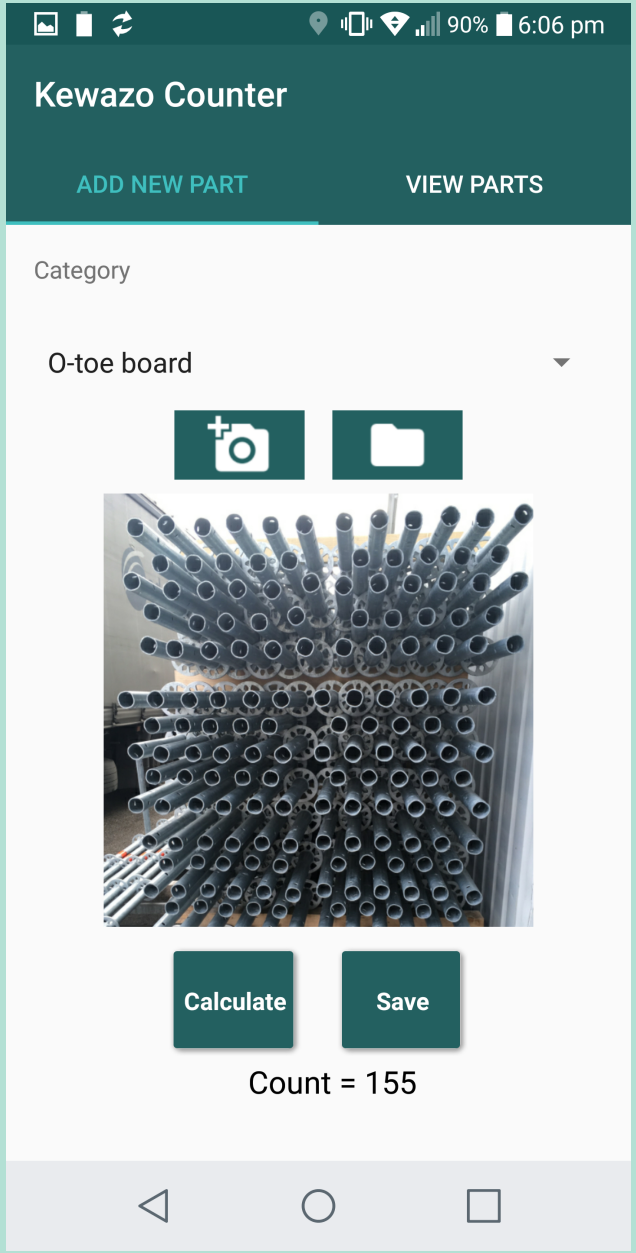
Solutions

- User can select source through gallery/camera
- Upon selection, user has to crop to get a template
- Algorithm requires CV libraries
- Package dependencies inside application, prevent additional steps



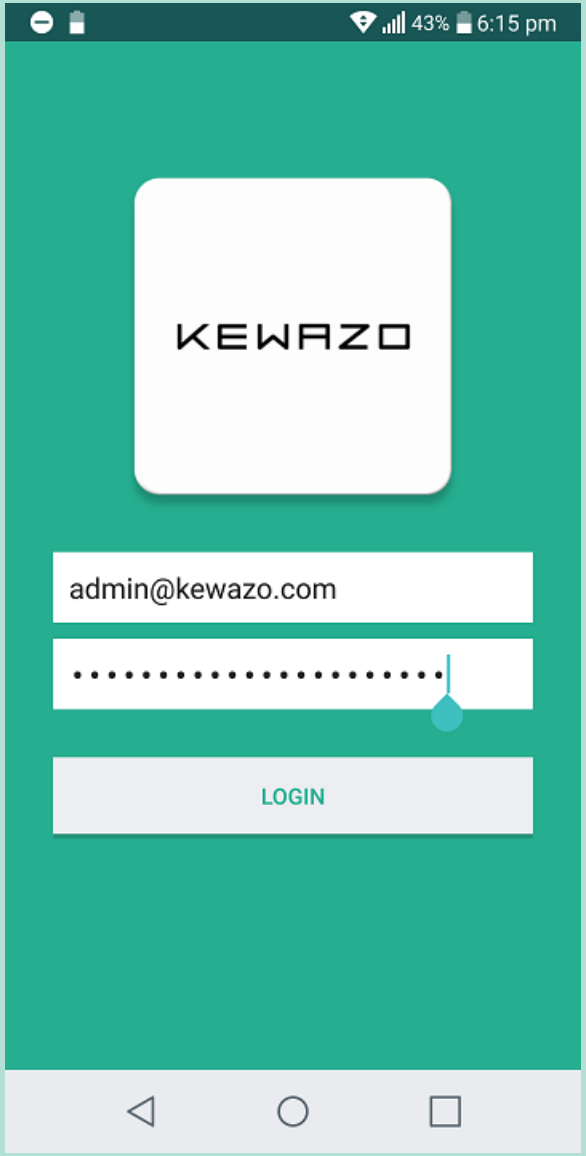
Results

- No need to install any external app
- User gets results in minimum clicks/taps



Prevent Unauthorized Usage

- Login functionality implemented at startup
- Authenticates with the KEWAZO Server



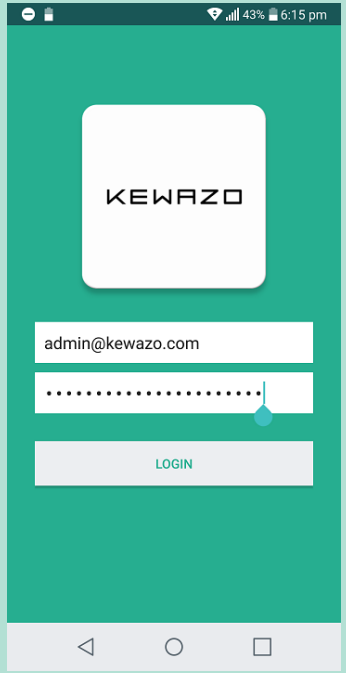
After Results – Future App Work

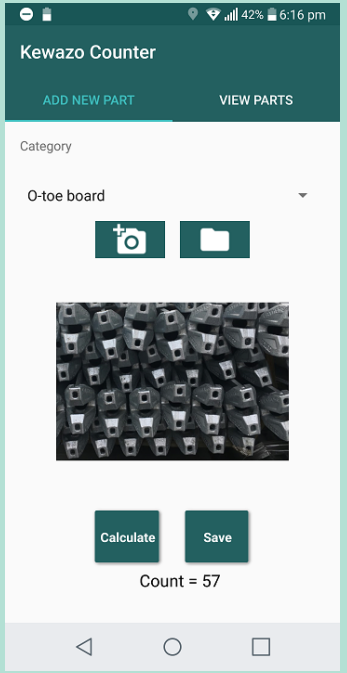
- Algorithm results
- We want to store data
- Available data
  - User id : kewazo@gmail.com
  - Image
  - Item Category : O toe steel rods
  - Item count : 35
  - Location
  - Date
- Store and retrieve data to/from a server

Future Algorithm Work

- Recognize the template automatically
- Use more Machine Learning techniques with larger dataset
- Real-time image recognition without taking a source

Q&A


43% 6:15 pm
KEWAZO
admin@kewazo.com
LOGIN


42% 6:16 pm
Kewazo Counter
ADD NEW PART
VIEW PARTS
Category
O-toe board
Calculate
Save
Count = 57