



# A VISION-BASED INTELLIGENT SYSTEM FOR EYE CLINIC

## PROPOSAL PRESENTATION

### Team Members

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Li Zhenghao, Kelvin



# Project sponsor (Kelvin)

- This is a self-sponsored project relating to the healthcare domain
- There is no real-world dataset available for this project:
  - Open-Source dataset
  - Create our own dataset
- Domain expertise will be provided by team member, Kelvin Li

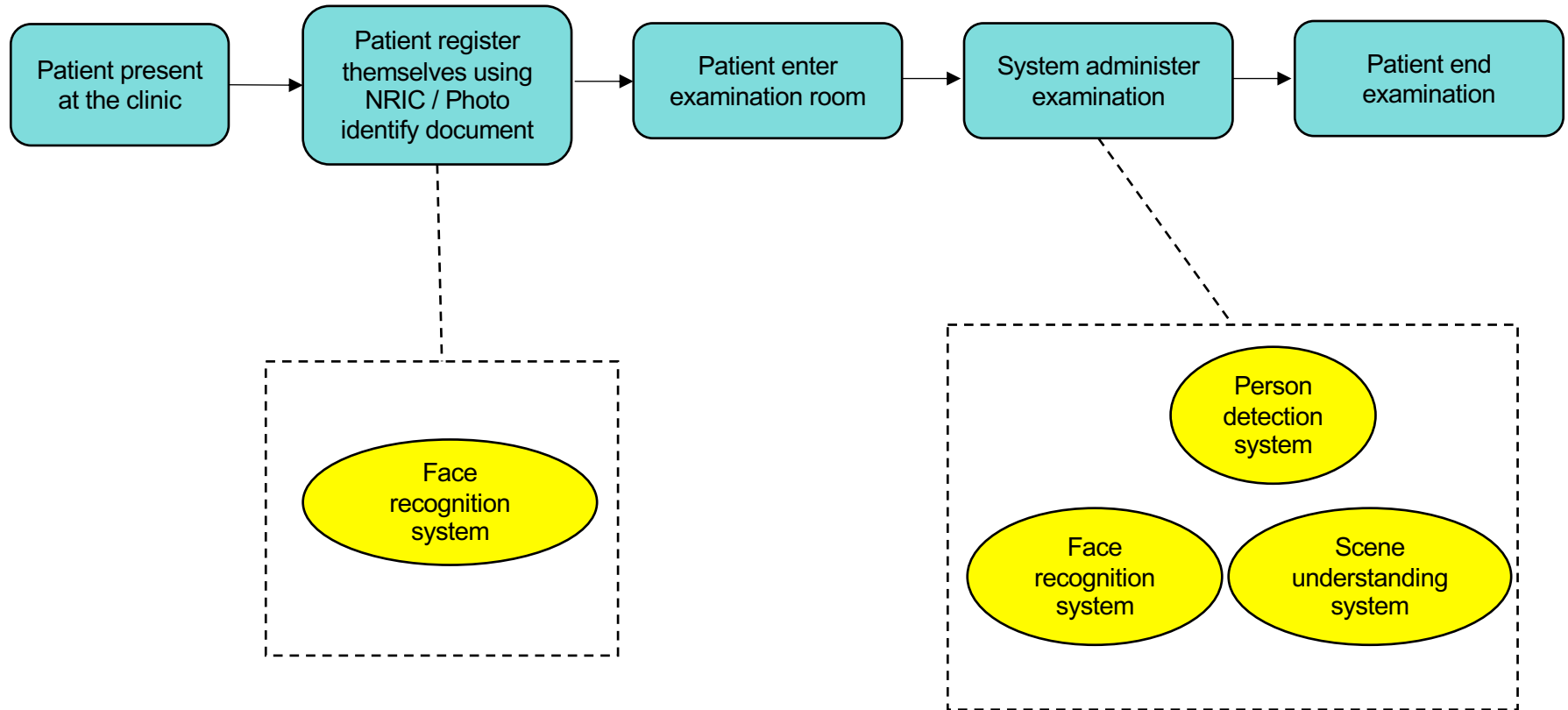


# Business problem statement (Kelvin)

- Specialist clinics in hospital are overwhelm
- Clinical staffs are occupied by routine basic examination work
- Objective:
  - Free clinical staff capacity by automating routine and low-risk health examination work
  - Develop a vision-based system to observe and interact with patients
- Impact:
  - Our vision system will should easily adapt to different types of clinic in Singapore
  - Help to ease the manpower crunch and improve efficiency in delivery of healthcare services in Singapore

- To design and develop an intelligent vision system for Smart Health Teleconsultation
- The system should have these capabilities:
  - Image-Based person identification
  - Ability to detect and count the number of person in the view
  - Ability to detect the presence and absence of objects present on the person's face
  - Ability to detect the orientation of the eyes
  - Ability to detect and recognize body gesture for touchless operation

# Solution Overview (Xiaohui)





# Technical problem statement (Xiaolan)

- Patient Registration: A system that can perform patient registration and identify through vision-based recognition system.
- Scene Understanding: The vision system must be able to understand the situation of the scene and provide suggestion actions.
  - Example 1: Only patient can be presented in examination room. Any other persons must be asked to leave the room before the examination starts.
  - Example 2: The system may instruct the patient to perform certain actions. The vision system must be able to recognize that the patient has performed the correct actions before proceeding to the next step.



# Related work (Xiaolan)

## Existing Implementations:

- <https://informatics.bmj.com/content/22/3/323>
- <https://www.uspharmacist.com/article/solohealth-launches-interactive-vision-test-kiosk>
- <https://drugstorenews.com/otc/pursuant-health-intros-retinal-screening-its-self-service-retail-kiosks>
- **Related works:**
  - Facial Recognition System
  - Object Detection system
  - Remote Patient Monitoring

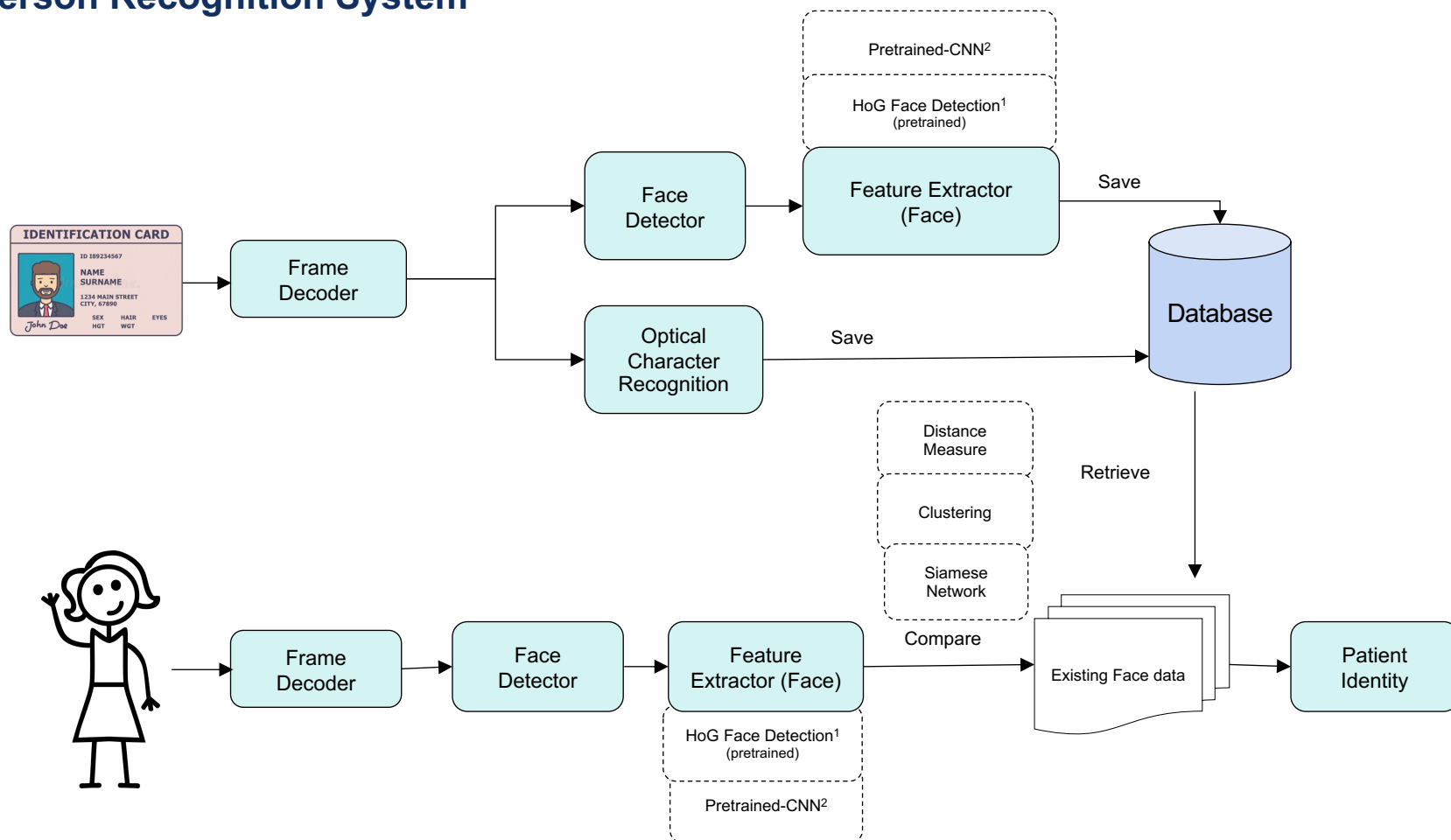
	Face Recognition System	Person detection system	Scene Understanding System
Existing Model	<ul style="list-style-type: none"> <li>Self-develop</li> </ul>	<ul style="list-style-type: none"> <li>YOLO</li> <li>OpenCV</li> </ul>	<ul style="list-style-type: none"> <li>Self-develop</li> </ul>
Dataset	<ul style="list-style-type: none"> <li>MS-Celeb-1M</li> <li>iQiYi-VID</li> </ul>	<ul style="list-style-type: none"> <li>MS-Celeb-1M</li> <li>iQiYi-VID</li> <li>INRIA Person Dataset</li> </ul>	<ul style="list-style-type: none"> <li>Self-generated</li> </ul>





# Proposed technical approach

## Person Recognition System



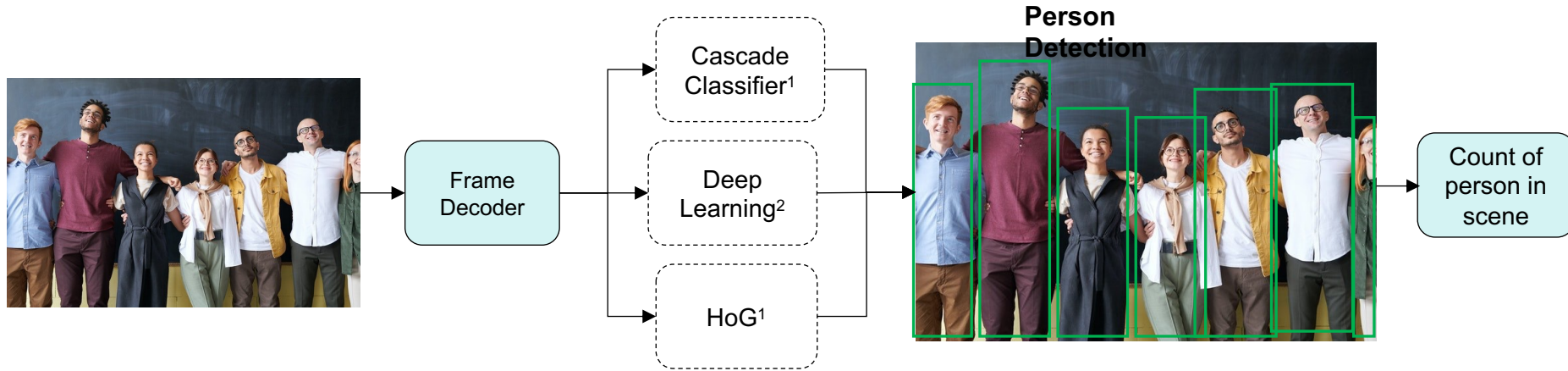
### References

1. dlib HoG Face feature detection: [http://dlib.net/face\\_detector.py.html](http://dlib.net/face_detector.py.html)
2. Keras CNN model zoo: <https://keras.io/api/applications/>



# Proposed technical approach

## Person Detection System



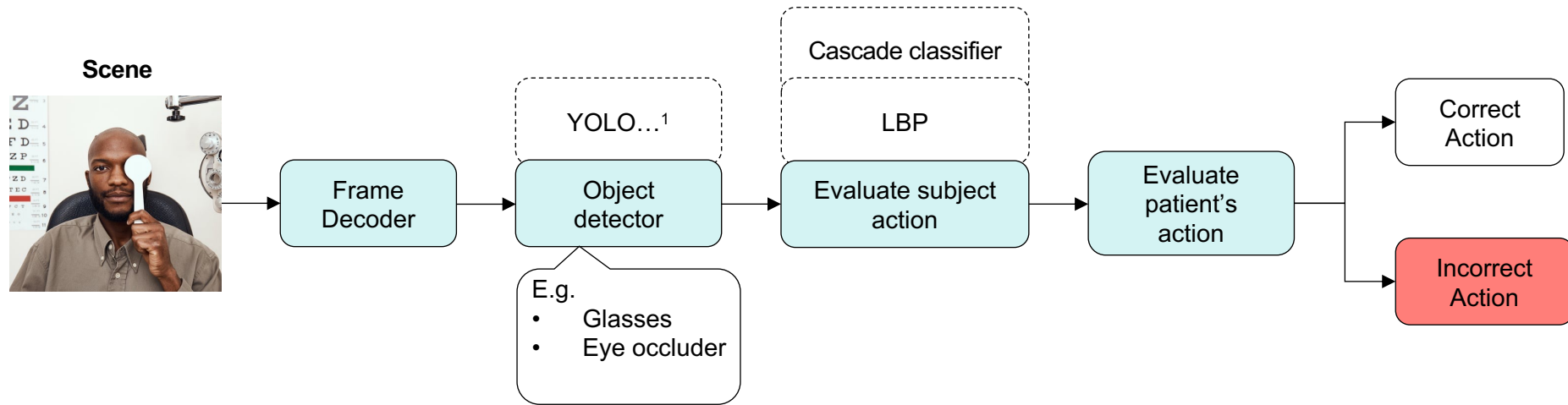
### Reference

1. OpenCV models: <https://github.com/opencv/opencv/tree/master/data>
2. Keras Pretrained models: <https://keras.io/api/applications/>



# Proposed technical approach

## Scene understanding system



### Reference

1. You Only Look Once: Unified, Real-Time Object Detection: <https://arxiv.org/abs/1506.02640>

## Technical metrics

- Accuracy and Precision evaluation for each model during training and validation
- Accuracy and Precision evaluation actual usage
- Inference speed comparison

## Business metrics

- Time reduction between manual process versus automated process
  - Achieve by setting up mock to emulate real-world process and compare the time taken for current workflow versus improve workflow with our solution

- Will deliver an end-to-end intelligent system that interacts with patient from the registration stage to the end of examination
- Will deliver a video demonstration of the capability of the vision system, namely:
  - Capturing image data from patient photo ID
  - Ability to detect person in the scene, and
  - Perform person identification by facial features
  - Ability to detect and identify objects or obstruction on person's face
  - Ability to correct classify if the person has performed the correct actions (e.g., cover left eye or right eye)

# Team members' responsibility

Team member	Responsibility
Zhong Xiaohui	<ul style="list-style-type: none"><li>• Team Lead</li><li>• UX Designer</li><li>• AI Engineer for Person Detection System</li><li>• Project manangement</li></ul>
Zheng Xiaolan	<ul style="list-style-type: none"><li>• Dataset creation and annotation</li><li>• Background research</li><li>• AI Engineer for Scene understanding system</li></ul>
Lim Chang Siang	<ul style="list-style-type: none"><li>• Dataset sourcing</li><li>• Establish AI workflow for model development</li><li>• AI Engineer for Person Recognition System</li><li>• Software development and system integration</li></ul>
Li Zhenghao, Kelvin	<ul style="list-style-type: none"><li>• Domain Expert / Product Owner</li><li>• Dataset creation and annotation</li><li>• AI Engineer for Scene understanding system</li><li>• System evaluation</li></ul>

- List the relevant references.