Work Report - Hand Gestures Recognition

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實驗結果

Introduction

- Gestures refer to the movements, postures, and facial expressions made by individuals
- My role in the team is to use **machine learning** techniques to detect and interpret gestures in real-time through a webcam.
- My goal is to develop a **robust** and **reliable** model.

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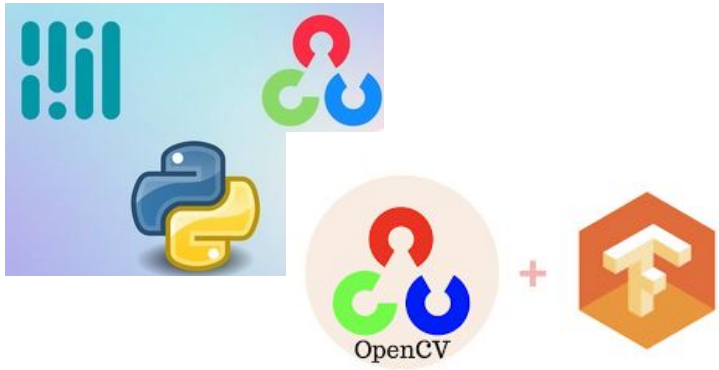
Objectives



- Develop a deep learning-based model (prob. Resnet)
- Collecting a large dataset.
- Using OpenCV, Mediapipe and TensorFlow, and optimize its performance.
- Final Aspect of Goal is to control the Robotic Fish with Hand Gestures
  - for controlling speed (faster/slower)
  - for controlling depth of the fish (deep-in/out)
  - for custom movements of fish - to circle round-around the fish
  - for moving forward towards the controller

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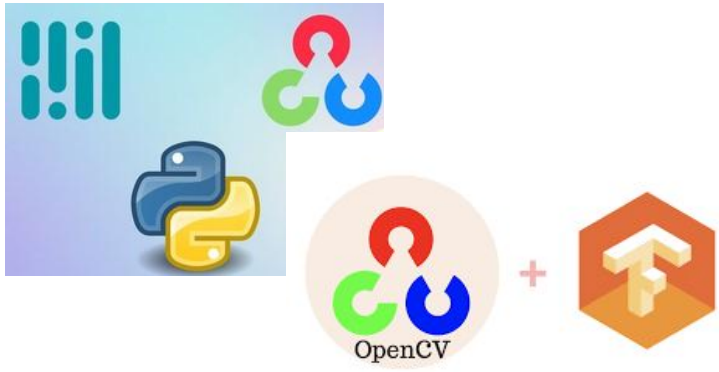
Approach



1. Custom data collection
2. Preprocessing and augmentation
3. Using Mediapipe's pre-trained Hand Recognition Model (to recognize the hand key points. Mediapipe returns a total of 21 key points for each detected hand.)
4. Generating training data for Resnet model
5. Training Resnet model for gesture recognition
6. Evaluating and optimizing model performance
7. Testing and validating the application on different datasets and scenarios

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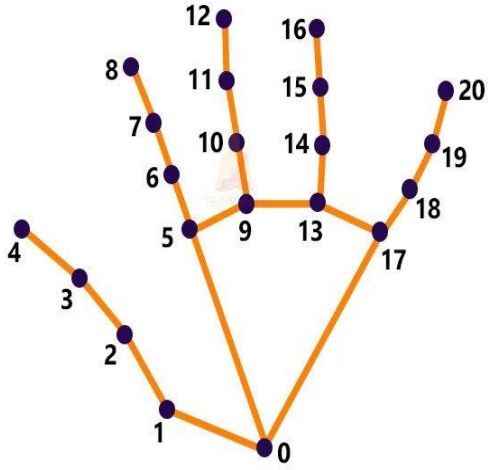
Approach



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

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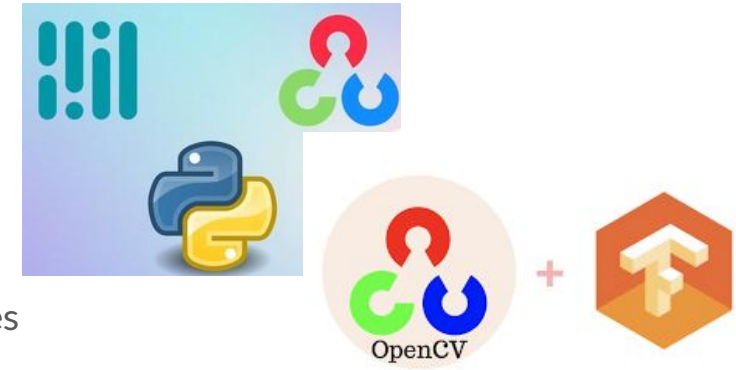
Current Work



1. Using Mediapipe model detected the Hand Co-ordinates
2. Classified the labelled data samples using SVM
3. Needed to improve the accuracy using Deep learning Model.

Future Work

I will implement the model using Resnet Model instead of simple SVM (Linear)

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Literature Survey

Research Papers	Year
Development of hand gesture recognition system using machine learning	2021
Hand Gesture Recognition Based on Computer Vision: A Review of Techniques	2020
Hand Gesture Recognition for Sign Language Using 3DCNN	2020
Static Hand Gesture Recognition Based on Convolutional Neural Networks	2019
Hand Gesture Recognition with Convolution Neural Networks	2019
Real-time Hand Gesture Detection and Classification Using Convolutional Neural Networks	2019

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Using Radar vs Camera

Radar for Gesture Recognition and Face Recognition:

- **Non-visual: Radar technology uses radio waves, it suitable for gesture recognition in low-light or no-light conditions.**
- **Robustness: Radar is less affected by environmental factors such as lighting conditions, shadows, reflections, allowing for more consistent gesture recognition.**
- **Distance: Radar can detect gestures from a relatively longer range compared to cameras, which can be beneficial in our scenario of Robotic Fish.**
- **Privacy: It can potentially offer better privacy protection compared to cameras, as it doesn't capture detailed visual information.**
- **Uniqueness: Radar can capture unique biometric features of a person's face, such as the shape and movement of facial muscles, contributing to accurate identification.**

Camera for Gesture Recognition and Face Recognition:

- **Visual cues: Cameras capture high-resolution visual information. (which is not required in our case, even we can do face recognition by using Radar by 3d Stimulation)**
- **Multi-modal applications: Cameras can capture both visual and depth information, allowing for multi-modal gesture recognition by combining visual cues with depth perception.**

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Using Infineon BGT60 Radar

BGT60LTR11SAIPXUMA1

影像僅供參考
請參閱產品規格

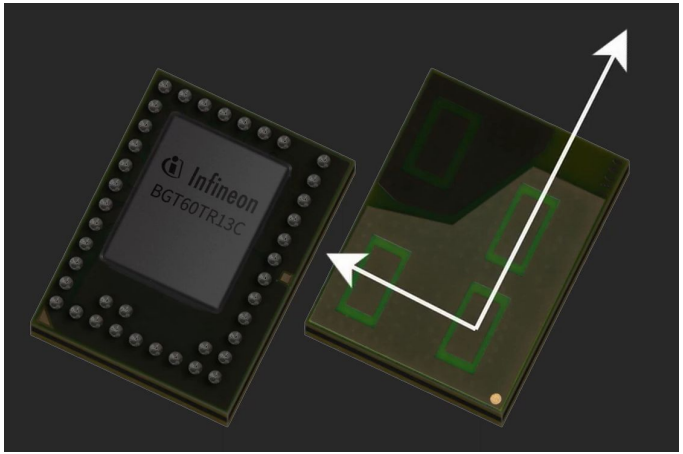
分享

Mouser 編號:	726-BGT60LTR11SAIPXU
製造商編號:	BGT60LTR11SAIPXUMA1
製造商:	Infineon Technologies
客戶編號:	客戶編號
說明:	距離感測器模組
壽命週期:	新產品: 該製造商的新產品。
規格書:	BGT60LTR11SAIPXUMA1 規格書 (PDF)
ECAD模型:	索取免費CAD模型

下載免費的庫載入器，為ECAD工具轉換此文件。瞭解更多關於 ECAD 型號的資訊。

更多資訊	瞭解更多關於Infineon Technologies BGT60LTR11SAIPXUMA1的資訊

比較產品　　新增至專案 | 添加記錄:



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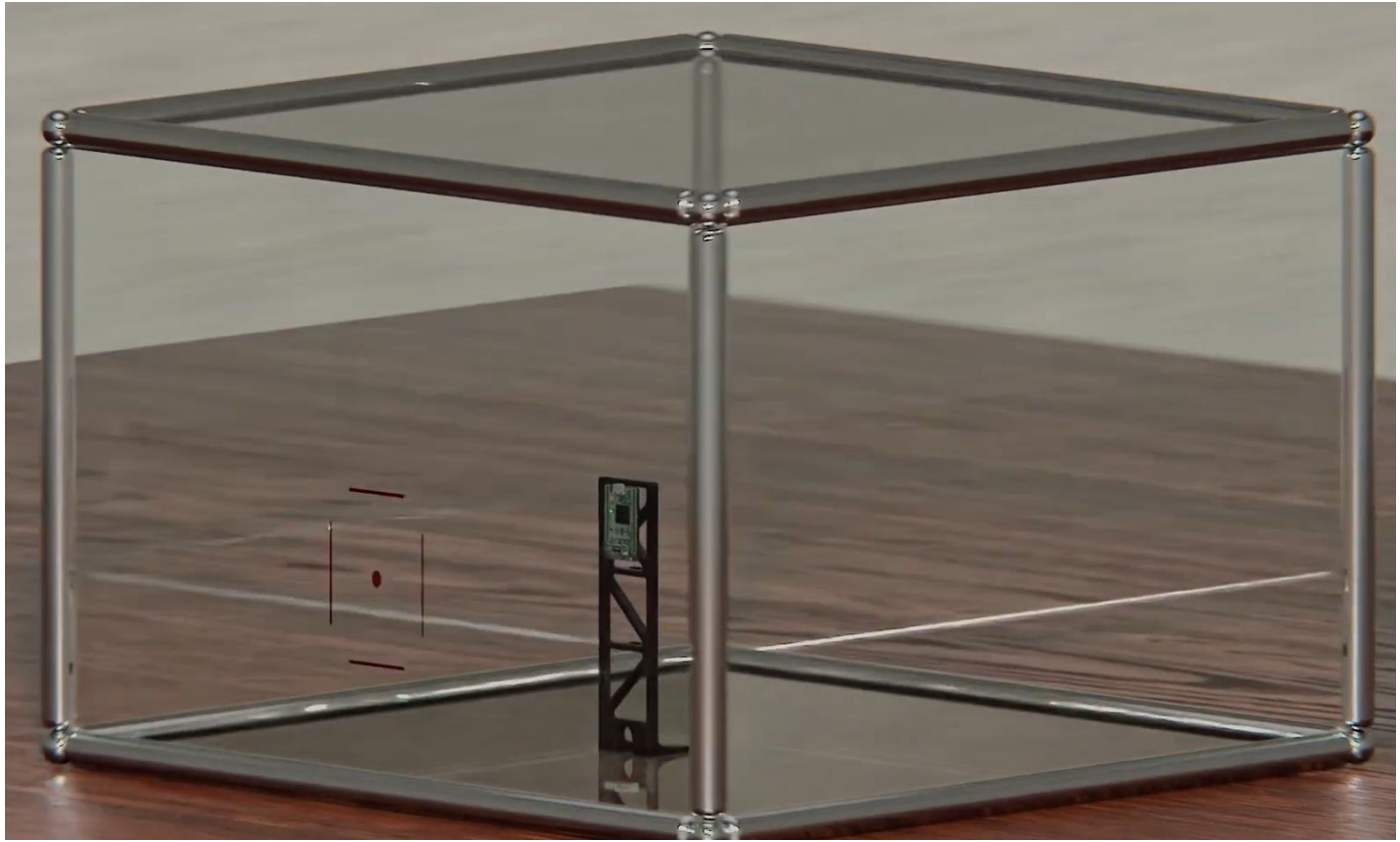
Using BGT60 Radar wide range usage



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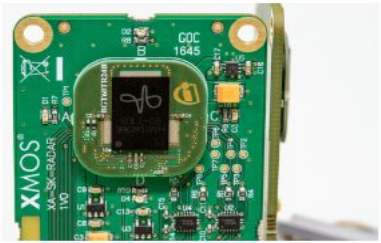
Combining Radar with Mircrophone



The building block makes use of Infineon's 60 GHz 2Tx/4Rx radar IC with accompanying antenna and the 70dB SNR microphone combined with an audio processor from XMOS.

XMOS_Soli_Chip
PNG | 1.13 mb | 2126 x 1417 px

The sensor fusion of Infineon's radar and MEMS microphone with audio processors from XMOS provides a new building block for voice recognition.

XMOS_demo
PNG | 449 kb | 2126 x 1417 px

The device provides far field voice capture by audio beamforming combined with radar target presence detection. Together, they guarantee for optimal sound recognition and flawless execution for digital voice assistance.

XMOS_picture_complete
PNG | 288 kb | 2126 x 1417 px

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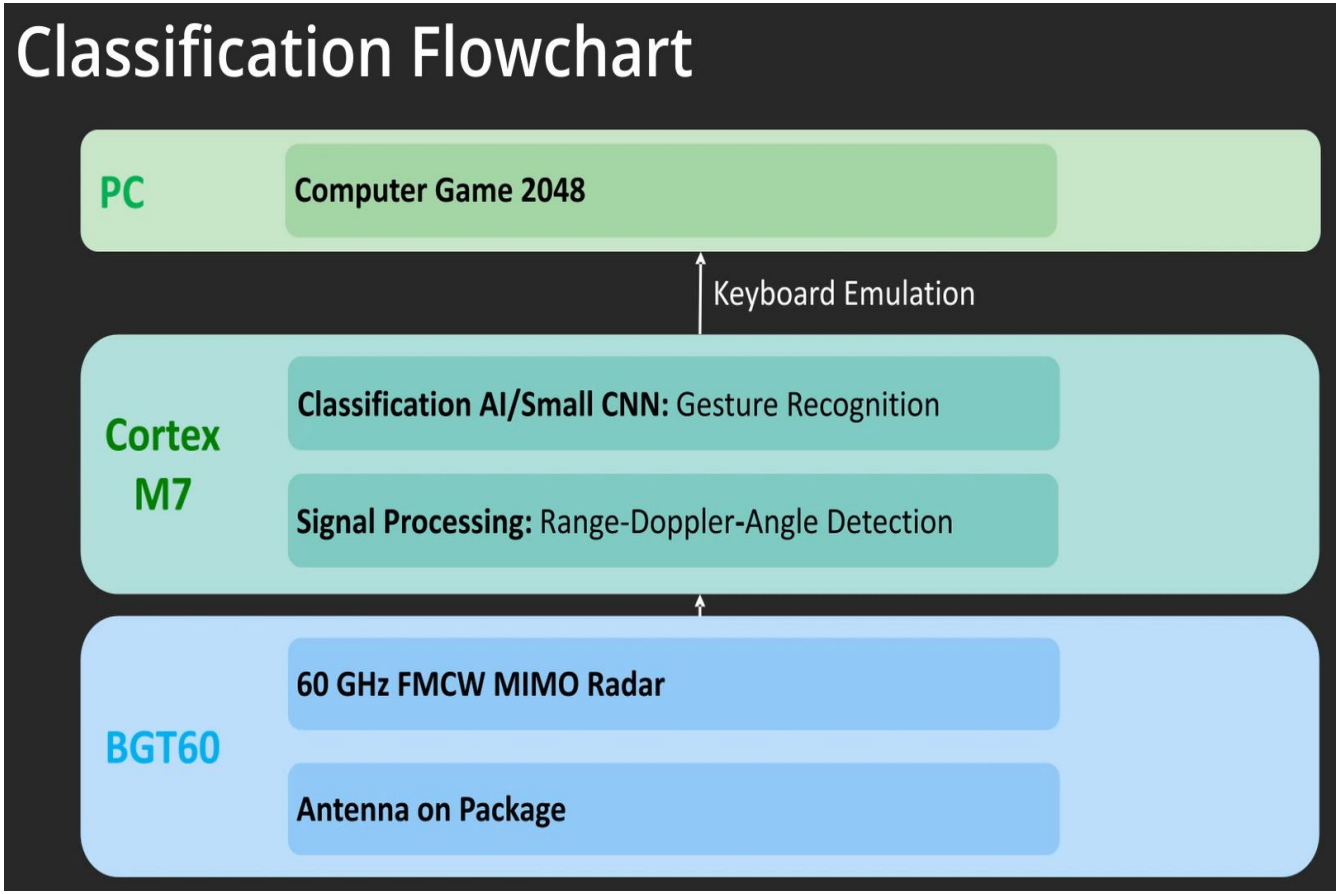

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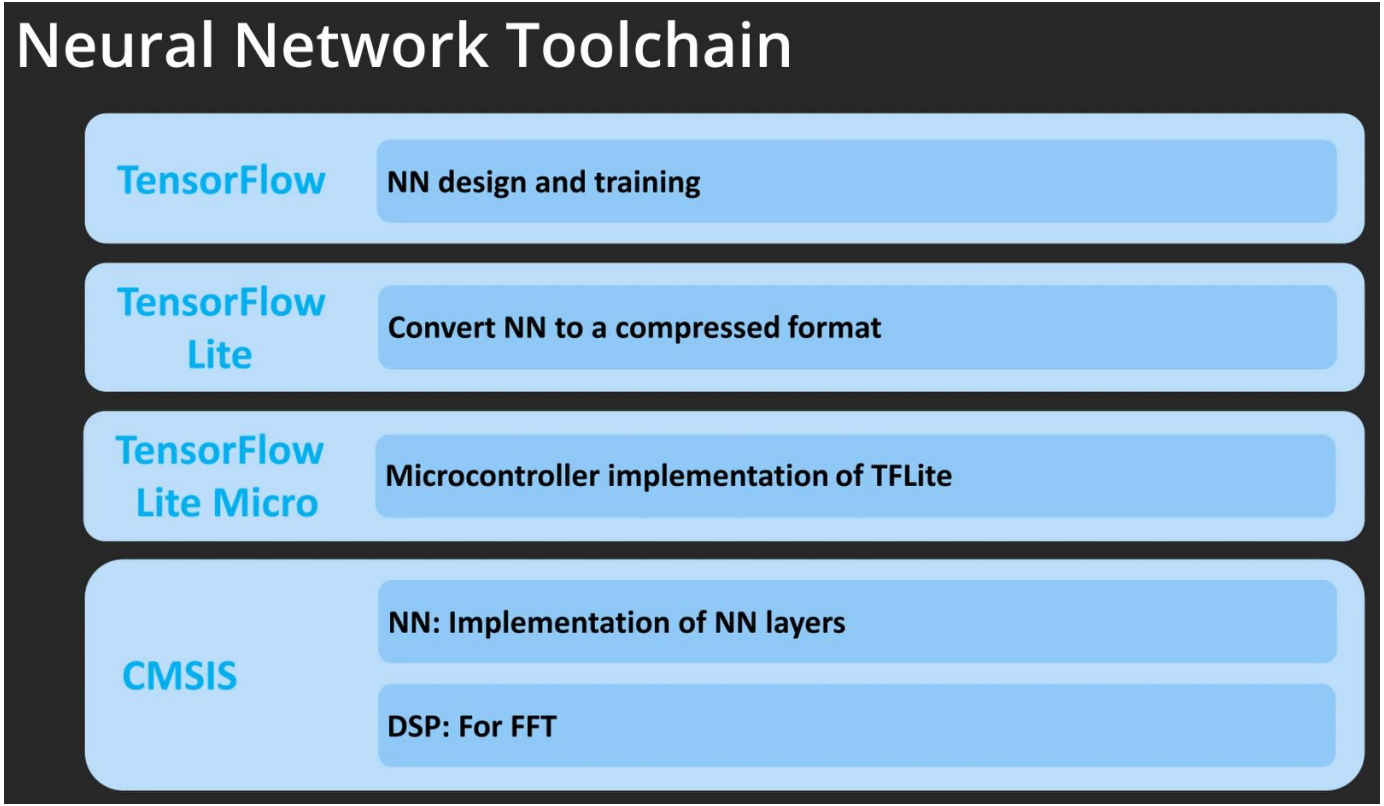

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Using Infineon BGT60 Radar