

Smoking Detection



using Google Coral

Team : TripleA

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1. Motivation

Motivation

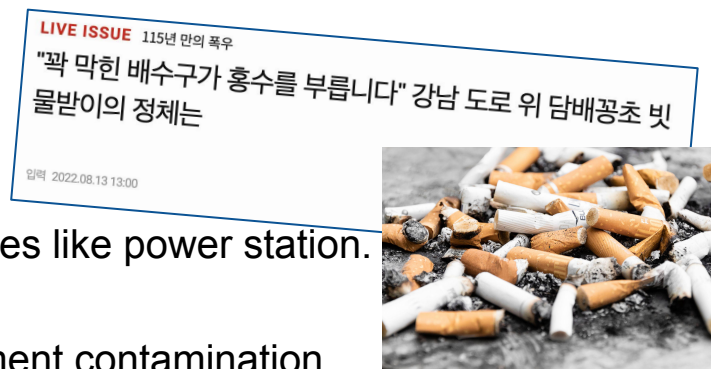
- Problem

① Safety Problem

In particular case, it can lead to serious accidents.
More dangerous especially nearby fire-sensitive places like power station.

② Environment Problem

Cigarette wastes thrown everywhere cause environment contamination.



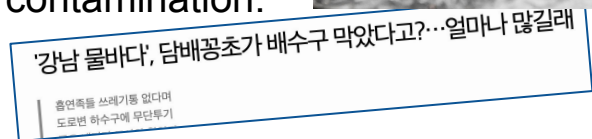
- Causation

① Lack of smoking area

287,200 non-smoking area / **7,089** smoking area in Seoul

② Lack of public awareness

People smoke cigarettes everywhere without moral conscience



출처 : MKNEWS, 한국일보

<https://www.mk.co.kr/news/society/view/2022/08/706192/>
<https://m.hankookilbo.com/News/Read/A2022081215070000668>
<https://news.mt.co.kr/mtview.php?no=2021051113425236128>

Life cycle of smoking detection model



2. System Overview

System Overview

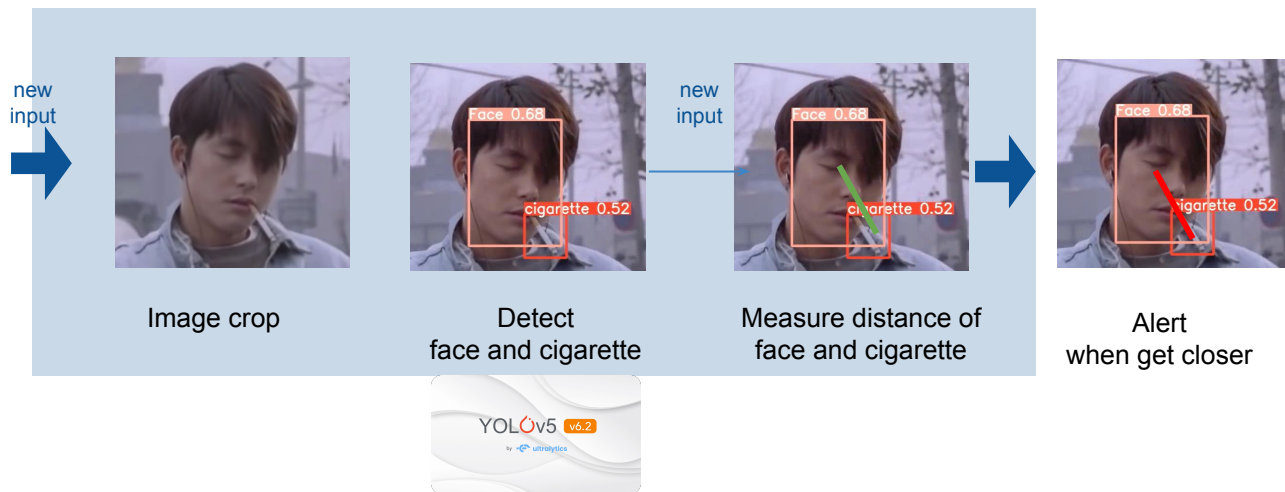
- **Why Vision?**
As micro hardware technologies has been developed, we are able to receive high quality images with smaller cameras. -> We want to use this benefit!
- **Why Object Detection?**
Can detect specific movement/object fast and prevent before smoking starts.
- **What is better than smoke detector?**
Faster prevention before smoking. Can detect specific smoker features.
- **Why Edge Device?**
Can be used widely in various places with less social/technical entry barrier. (e.g. privacy policy, server capacity, etc.)

Application Scenario in detail

- PHASE 1: Detect smoking pose → Crop → Input for phase 2 Object Detection
- PHASE 2: Detect face and cigarette → Measure distance → Alert

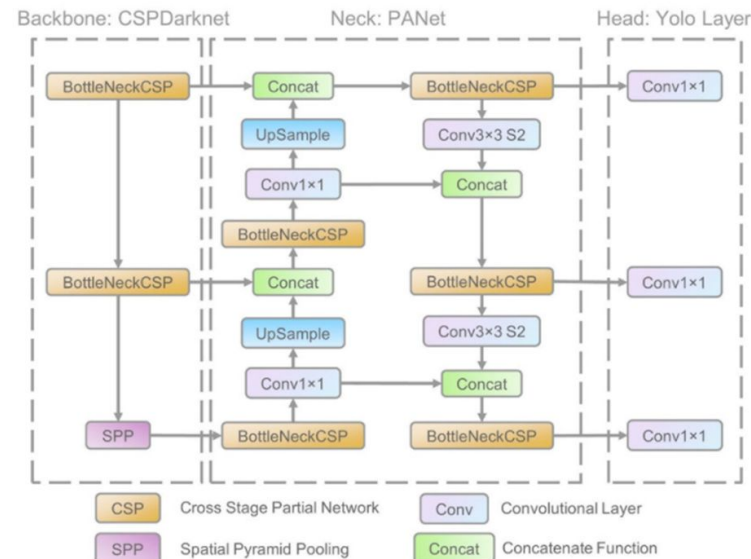
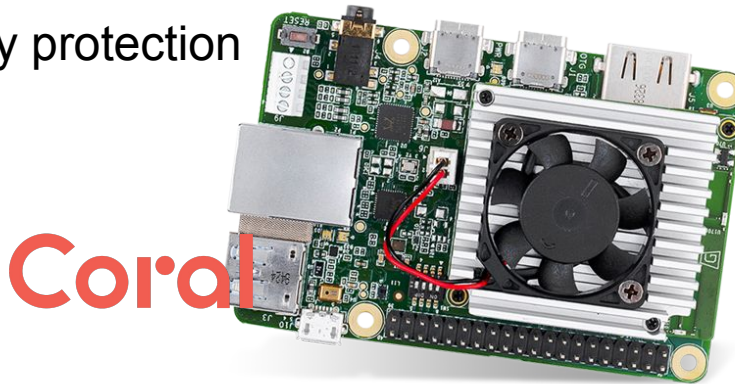


Detect Smoking pose



System Overview

- **Why yolov5?**
 - Great performance at object detection
 - Detailed source code exists
- **Why Coral?**
 - Collected data used locally
 - Privacy protection



*** YOLOv5(You Only Look Once)**
: Object Classification + Location Detection in one stage

3. Data Preparation

Data Preparation

Collect various size, angle, type of images to raise performance

	Cigarette	Face	Total
Train	8,983	8,553	17,536
Validation	1,020	1,843	2,863
Total	10,003	10,396	20,399

4. Challenges

Challenges 1 - Masking

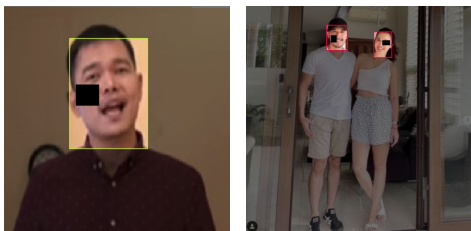
- **Problem**

Cannot detect face when part of it is hidden.

- **Solution**

Added face datasets which include masking.

Examples.



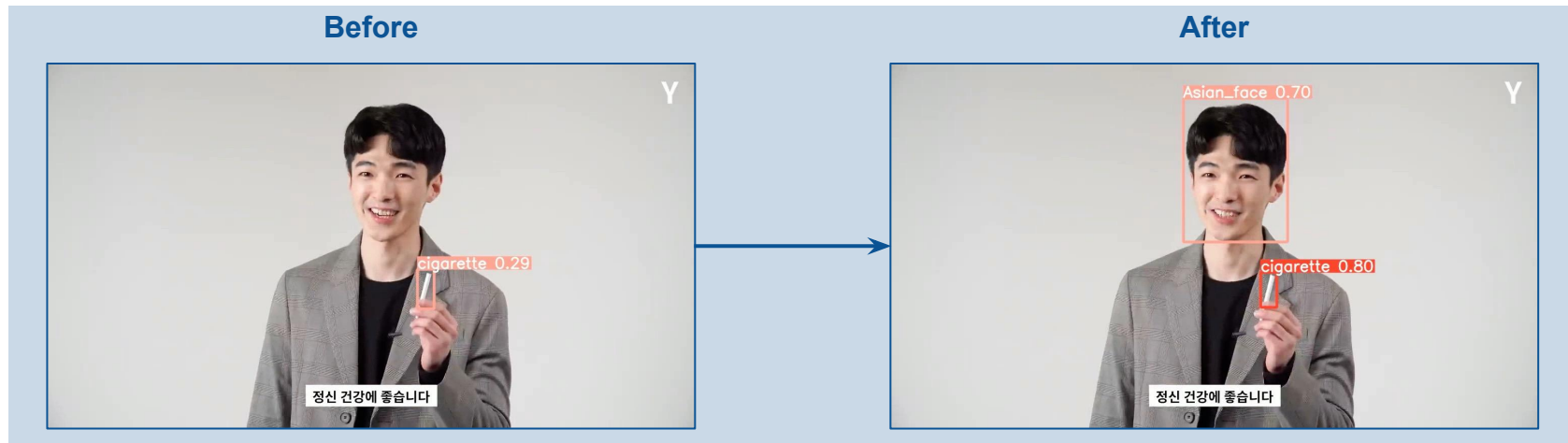
Challenges 2 - Race

- **Problem**

Could not detect all races accurately. Especially asian faces were not detected.

- **Solution**

Collected dataset of asian faces and trained our model.



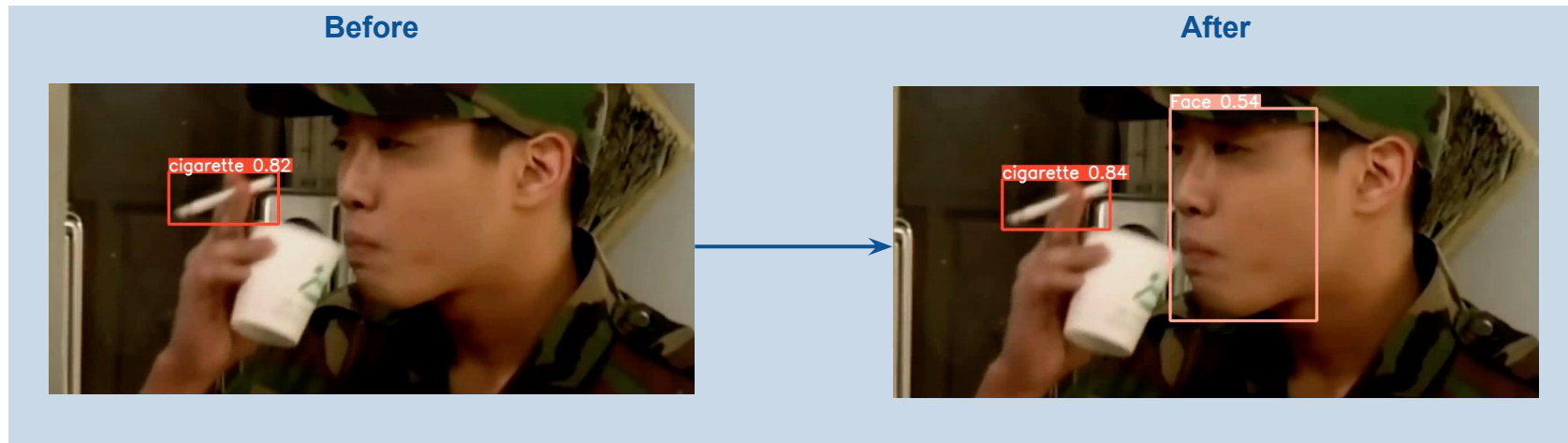
Challenges 3 - Various angle of Faces

- **Problem**

Failed to detect various angled faces occasionally.

- **Solution**

Collected more side face datasets.



Challenges 4 - else

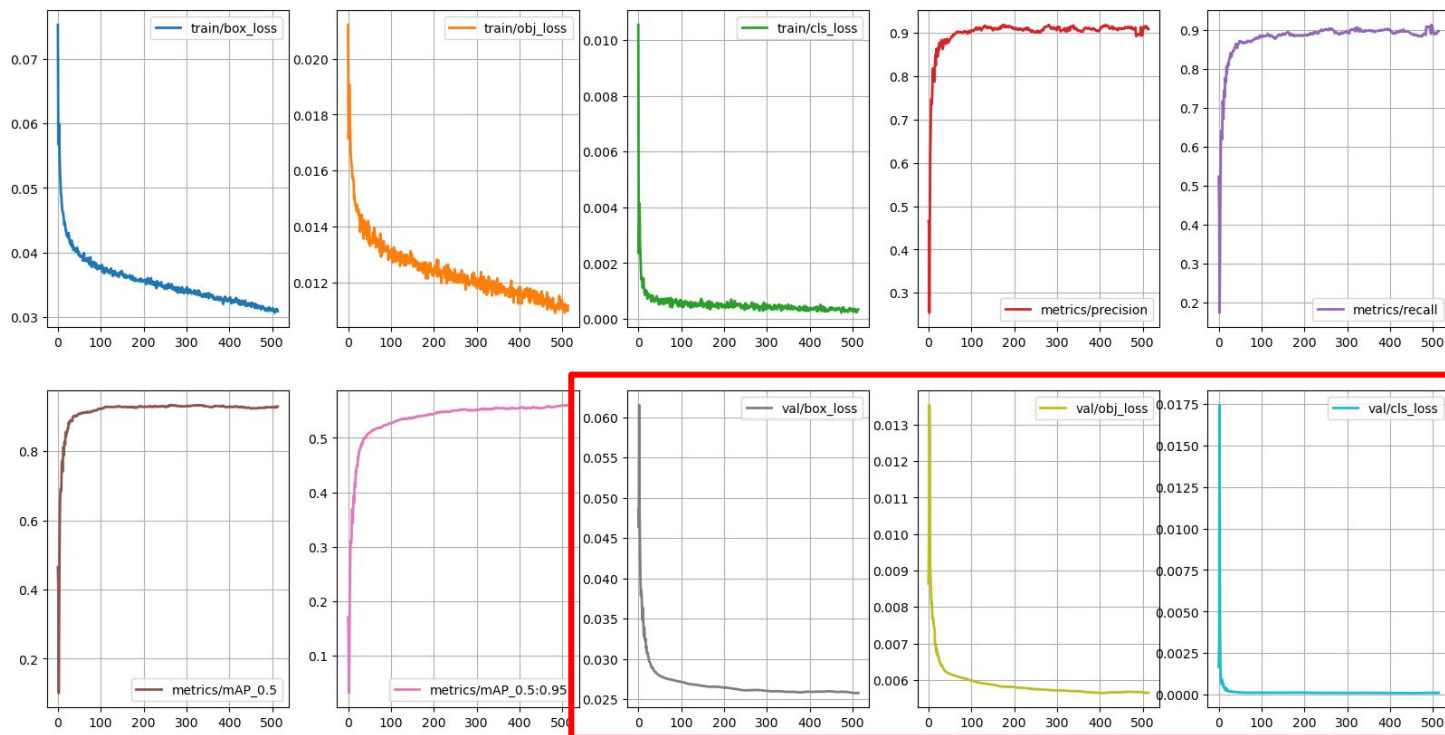
Other Problems

- Could not use gpu cluster until 4 days before the due date.
- Difficulty in collecting various types of face and cigarette data.
- Converting pytorch yolov5s model to edgetpu.tflite file was a huge challenge.



5. Results

Results

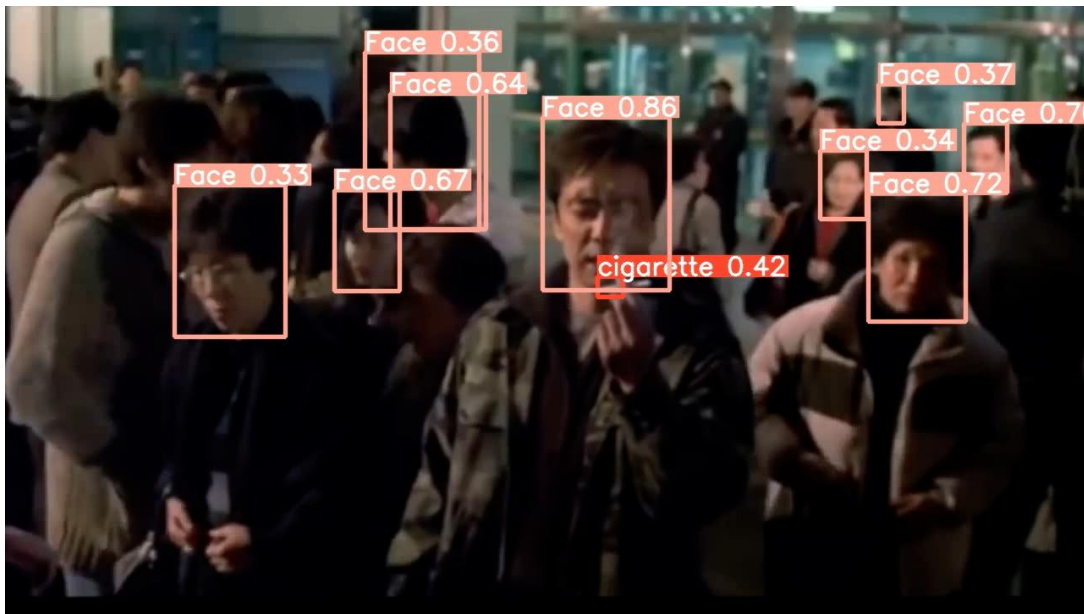


* Dataset(train:valid) = 20,399 [cigarette(8,983:1,020), face(8,553:1,843)]

* Hyperparameter = epoch : 515, batch : 48, img size : 640

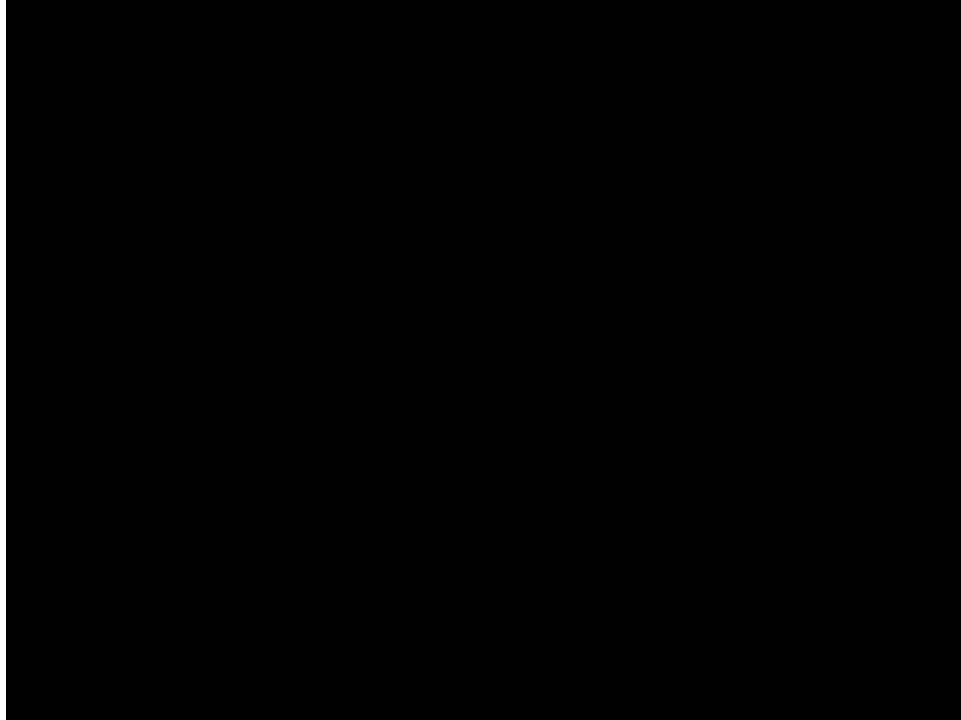
Results - Example

iou = 0.7, conf = 0.3



face, cigarette

Demo



6. Conclusion

Future Works

- Measure distance between face and cigarette.
- Alert smokers.
- Connect two-stage models as one to put in Google Coral
(Smoking-pose detection model, face - cigarette distance model)
- Detection of other objects related to cigarette (e.g. lighters, cigarette pack, smoke, etc.)

Conclusion

- Hard to distinguish between cigarette and seems-like cigarette object.
- Unstable detection. Needs more data and computing.
- Learned importance of dataset quality and balance.

Thank you