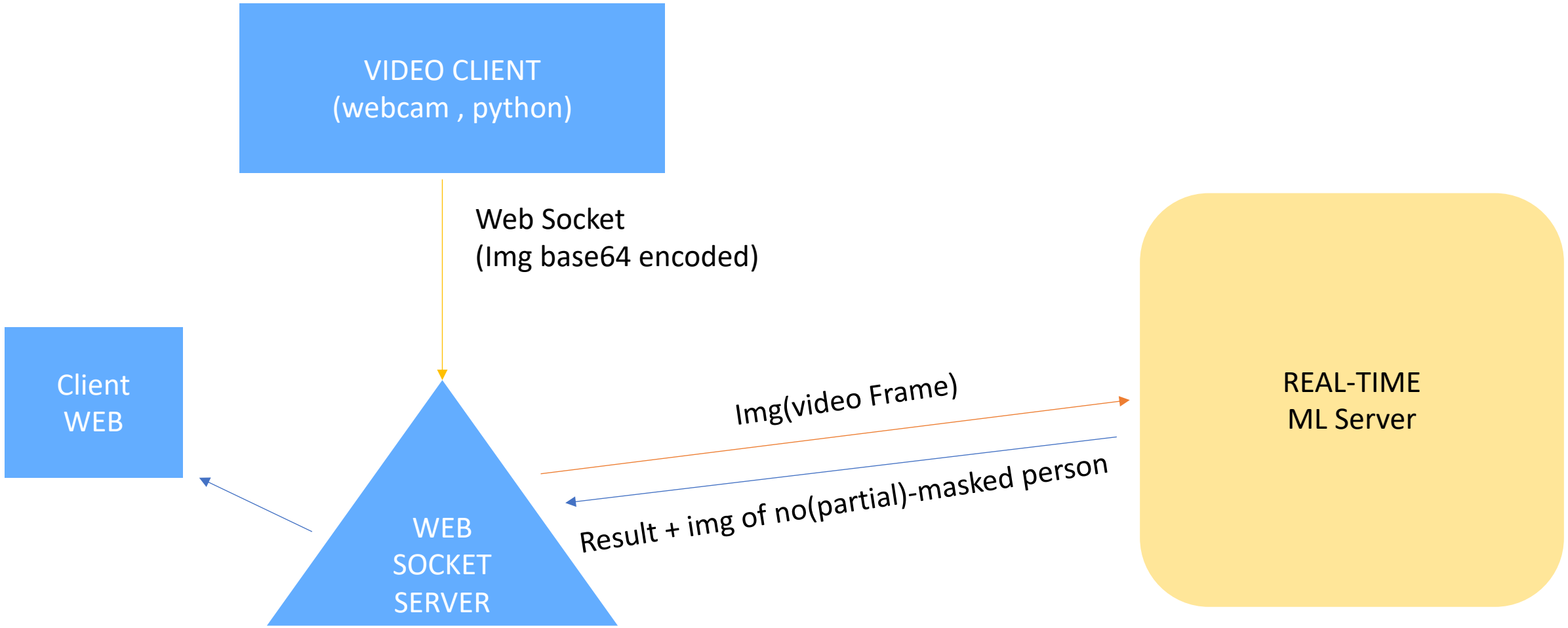
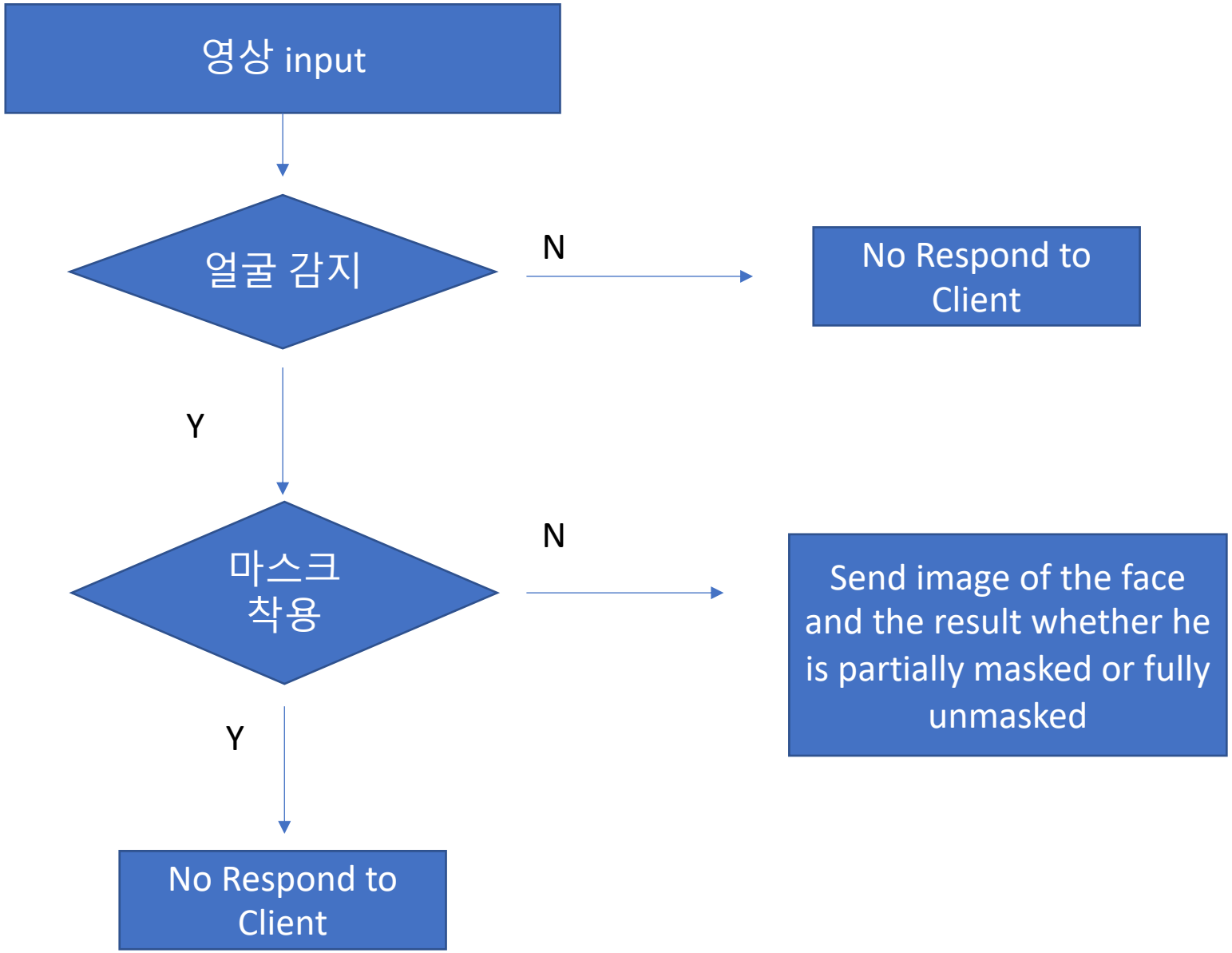
# 공공장소에서의 실내 마스크 착용 단속 보조 시스템

20192698 심원준

# 시스템 구성도


VIDEO CLIENT
(webcam , python)
Web Socket
(Img base64 encoded)
Client
WEB
WEB
SOCKET
SERVER
Img(video Frame)
Result + img of no(partial)-masked person
REAL-TIME
ML Server

# 알고리즘 순서도


영상 input
얼굴 감지
N
No Respond to Client
Y
마스크 착용
N
Send image of the face and the result whether he is partially masked or fully unmasked
Y
No Respond to Client

# 간트 차트

| Weeks | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Data Preparation** | | | | | | | | | | | | | | |
| Dataset Search | | | | | | | | | | | | | | |
| Dataset 준비 | | | | | | | | | | | | | | |
| preprocess | | | | | | | | | | | | | | |
| **Model preparation** | | | | | | | | | | | | | | |
| Model candidates searching | | | | | | | | | | | | | | |
| model experiment | | | | | | | | | | | | | | |
| **System Development** | | | | | | | | | | | | | | |
| Server achitecture plan | | | | | | | | | | | | | | |
| Server Coding | | | | | | | | | | | | | | |
| Debugging and testing | | | | | | | | | | | | | | |

# 데이터 셋

## 500 GB of images with people wearing masks. Part 1

Data | Code (2) | Discussion (2) | Metadata

35 | New Notebook | Download (86 GB)

### About Dataset

#### The largest dataset of people wearing face masks

250 000 images, 4 types of mask worn, 28 000 unique faces.
All images were collected using the Toloka.ai crowdsourcing service and validated by TrainingData.ru
Each item contains image size, photo type, person's age, gender, user ID.


#### TYPES

TYPE 1 - There is no mask on the face.
TYPE 2 - The mask is on, but does not cover the nose or mouth.
TYPE 3 - The mask covers the mouth, but does not cover the nose.
TYPE 4 - The mask is worn correctly, covers the nose and mouth.

**Usability**
9.41

**License**
Attribution-NonCommercial 4.0 I...

**Update frequency**
Unspecified

# 알고리즘 성능 평가

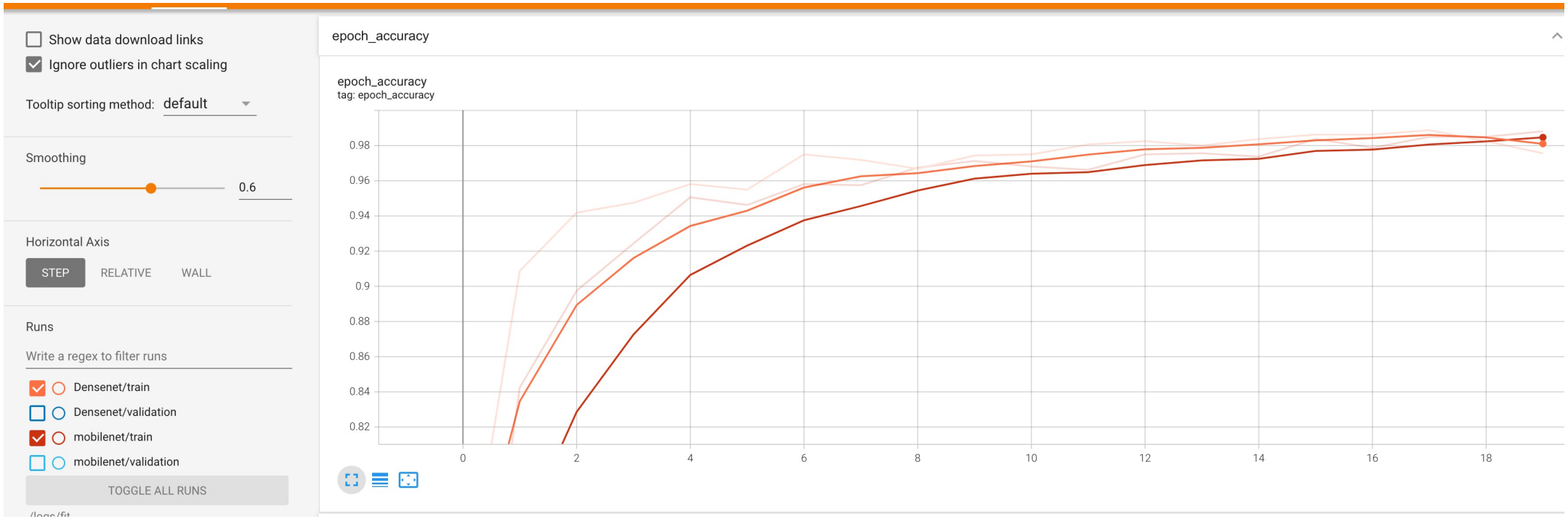
| 차수 | 1차 | 2차 | 3차 | 4차 |
|---|---|---|---|---|
| 모델 | Resnet50 | Resnet50 | Efficientnet | Densenet |
| Activation Function | SOFTMAX | | | |
| Model-trainable | False | True | | |
| Loss Function | MSE | Categorical Hinge | | |
| Epoch | 10,000 | 100 | 60 | 10 |
| Image Count (Train/val) | 1600 / 400 | | | |
| FC Layer | 128/64/4 | 256/256/4 | 256/256/4 | 256/256/4 |
| Label | (2000,1) -> Assigned integer (1~4) to the array | (2000,4) -> check 1 to the class it belongs | | |
| Accuracy | 0.1887 | 1.0000 | 0.9956 | 0.9450 |
| Val-Acc | 0.2075 | 0.9625 | 0.9576 | 0.9575 |
| Loss | 0.3741 | 0.0017 | 0.0137 | 0.1583 |
| Val-Loss | 0.3700 | 0.0746 | 0.0972 | 0.1339 |
| Auc(ROC) | NAN | 1.0000 | 0.9992 | 0.9912 |
| Val-auc | NAN | 0.9897 | 0.9844 | 0.9895 |

| 차수 | 5차 | 6차 | 7차 | 8차 | 9차 |
|---|---|---|---|---|---|
| 모델 | DENSENET | | | | |
| Activation Function | SOFTMAX | | | | |
| Model-trainable | True | | | | |
| Loss Function | Focal | MSE + HINGE | FOCAL+ HINGE | MSE + FOCAL | MSE FOCAL HINGE |
| Epoch | 15 | | | | |
| Image Count (Train/val) | 1600 / 400 | | | | |
| FC Layer | 256/256/4 | | | | |
| Label | (2000,4) -> check 1 to the class it belongs | | | | |
| Accuracy | 0.9438 | 0.9750 | 0.9413 | 0.9400 | 0.9388 |
| Val-Acc | 0.8750 | 0.9350 | 0.8475 | 0.8525 | 0.8650 |
| Loss | 0.0358 | 0.0112 | 0.0390 | 0.0392 | 0.0350 |
| Val-Loss | 0.1309 | 0.0259 | 0.1839 | 0.1409 | 0.1658 |
| Auc(ROC) | 0.9948 | 0.9972 | 0.9942 | 0.9941 | 0.9951 |
| Val-auc | 0.9753 | 0.900 | 0.9564 | 0.9652 | 0.9686 |

# 알고리즘 성능 평가

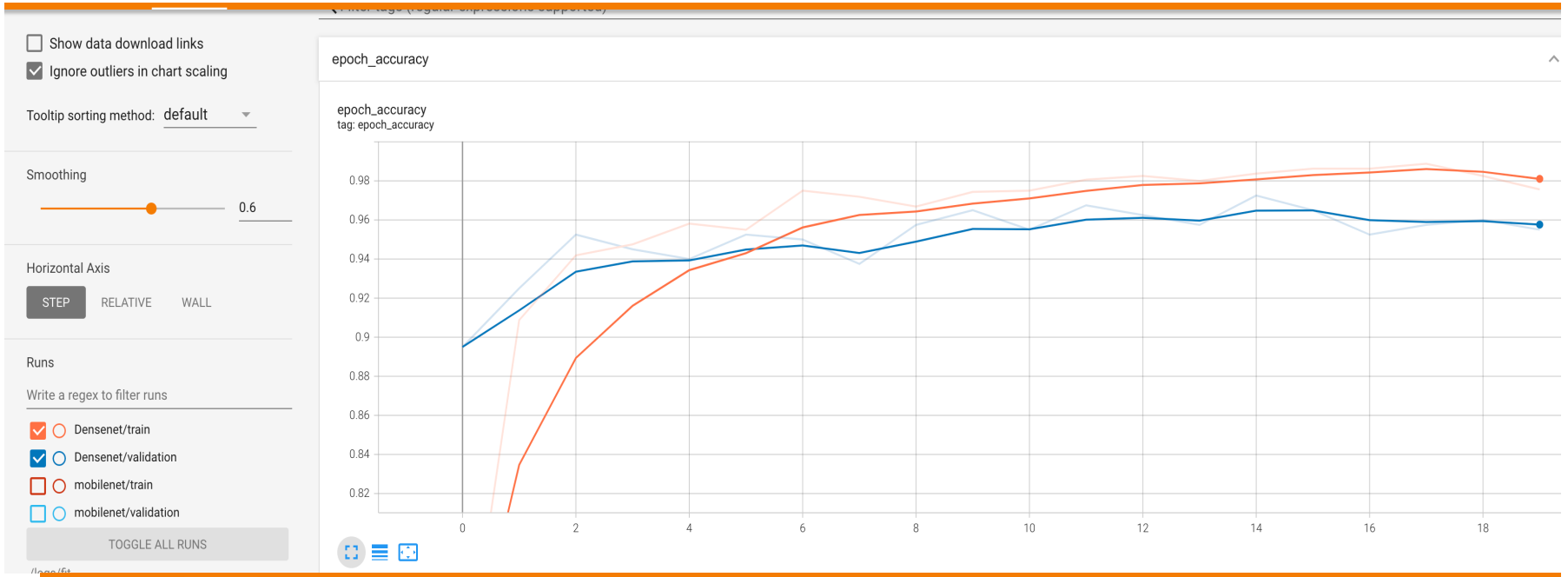
| NUM | 1 | 2 |
|---|---|---|
| 모델 | MobilenetV2 | Densenet121 |
| Activation Function | Softmax | softmax |
| Model-trainable | True | True |
| Loss Function | MSE + Hinge | MSE + Hinge |
| Epoch | 20 | 20 |
| Learning Rate | 0.0001 | 0.0001 |
| Image Count (Train/val) | 1600/400 | 1600/400 |
| FC Layer | 256/256/4 | 256/256/4 |
| Accuracy | 0.9812 | 0.9844 |
| Val-Acc | 0.9525 | 0.9675 |
| Loss | 0.0077 | 0.0062 |
| Val-Loss | 0.0197 | 0.0150 |
| Auc(PR) | 0.9963 | 0.9978 |
| Val-auc | 0.9727 | 0.9749 |
| 프레임(얼굴) 당 소요 시간 | 13ms | 18ms |

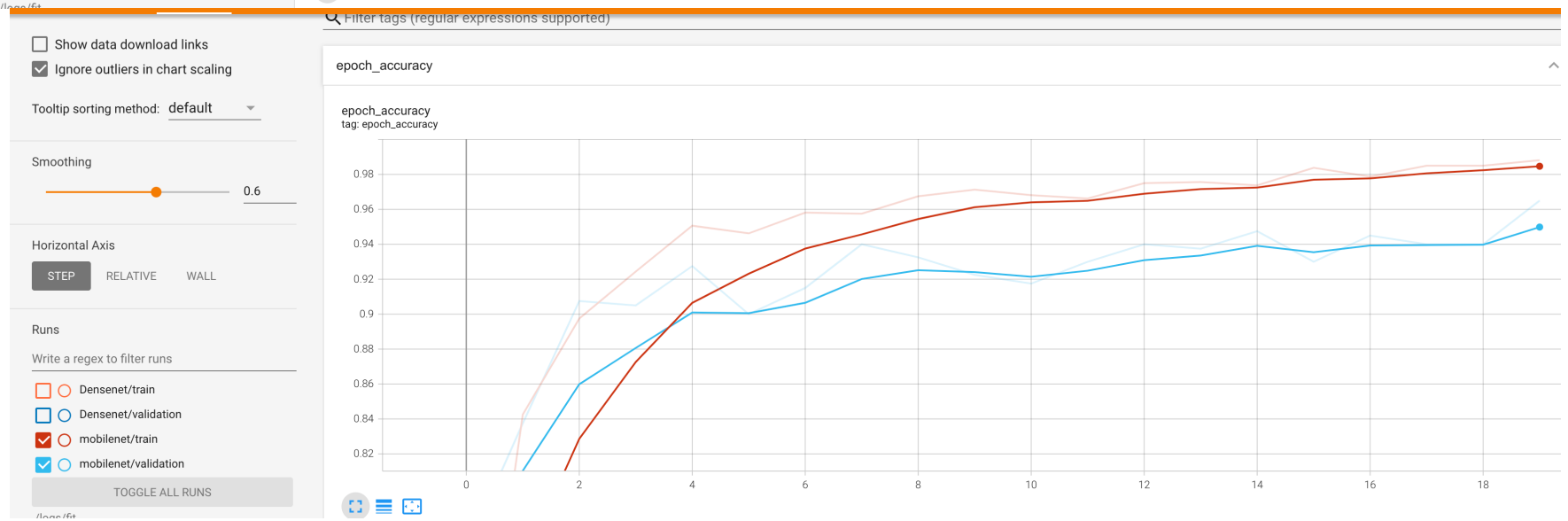
# 알고리즘 성능 평가 - Densenet과 mobilenet의 학습 횟수에 따른 accuracy변화



# 알고리즘 성능 평가

상: Densenet
하 : mobilenetV2



# 시스템 데모

마스크 미착용자 알림 프로그램

noMask

```
3.62706184387207e-05 seconds
1/1 [==============================] - 0s
[[8.25394760e-04 1.02748585e-04 4.8113250
noMask
3.6439180374145505e-05 seconds
1/1 [==============================] - 0s
[[9.4308634e-04 1.0060926e-04 3.3416314e-0
noMask
3.624320030212402e-05 seconds
```

마스크 미착용자 알림 프로그램

partialMask

```
masked
3.67121696472168e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[9.9338323e-01 6.2031825e-03 5.9272456e-06 4.0763678e-04]]
masked
3.653383255004883e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[9.9622393e-01 3.5003948e-03 4.3313744e-06 2.7129284e-04]]
masked
3.63309383392334e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[9.9394774e-01 5.5240993e-03 5.5828382e-06 5.2253308e-04]]
masked
3.6377429962158204e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[4.0312116e-06 9.9943215e-01 5.4136995e-04 2.2390635e-05]]
텍스크
3.618812561035156e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[1.2267848e-05 9.9950254e-01 4.7395387e-04 1.1219199e-05]]
텍스크
3.55675220489502e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[4.6308007e-05 9.9976569e-01 1.8101862e-04 6.9150597e-06]]
텍스크
3.634095191955567e-05 seconds
```

마스크 미착용자 알림 프로그램


```
masked
3.63309383392334e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[9.9394774e-01 5.5240993e-03 5.5828382e-06 5.2253308e
masked
3.6377429962158204e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[4.0312116e-06 9.9943215e-01 5.4136995e-04 2.2390635e
텍스크
3.618812561035156e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[1.2267848e-05 9.9950254e-01 4.7395387e-04 1.1219199e
텍스크
3.55675220489502e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[4.6308007e-05 9.9976569e-01 1.8101862e-04 6.9150597e
텍스크
3.634095191955567e-05 seconds
1/1 [==============================] - 0s 22ms/step
[[1.7088407e-05 9.9979848e-01 1.7740813e-04 7.1292511e
텍스크
5.840897560119629e-05 seconds
1/1 [==============================] - 0s 18ms/step
[[9.9783128e-01 2.0428430e-03 4.6511627e-06 1.2117199e
masked
3.68645191192627e-05 seconds
```

마스크 미착용자 알림 프로그램

partialMask

```
텍스크
2.6559829711914064e-05 seconds
1/1 [==============================] - 0s 12ms/step
[[0.00131878 0.7099739  0.11688293 0.1718244 ]]
텍스크
2.6630163192749022e-05 seconds
1/1 [==============================] - 0s 12ms/step
[[0.00130844 0.3222039  0.04014703 0.6363407 ]]
noMask
2.663445472717285e-05 seconds
1/1 [==============================] - 0s 12ms/step
[[0.00309758 0.59941417 0.11000746 0.28748083]]
텍스크
2.961564064025879e-05 seconds
1/1 [==============================] - 0s 12ms/step
[[2.6174285e-04 5.7520342e-01 3.5201928e-01 7.2515540e-02]]
텍스크
2.684950828552246e-05 seconds
1/1 [==============================] - 0s 12ms/step
[[0.00122029 0.8202181  0.15034299 0.0282187 ]]
텍스크
2.6653766632080077e-05 seconds
1/1 [==============================] - 0s 12ms/step
[[0.00111069 0.8335669  0.12567799 0.03964442]]
텍스크
2.6729822158813476e-05 seconds
```