

최종 발표

2024

Canon Project



1조
Eigenvectors

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시나리오

STEP.01 바코드 리딩



바코드 리딩을 통한
기종 정보 리딩

STEP.02 이미지 취득



고정형 카메라 1, 2로
동시에 이미지 취득

STEP.03 Pass/Fail 판단



각 기종에 대한
올바른 언어 사용 및
ROI 영역 침범 여부 판단

STEP.04 최종 판정



카메라 1, 2 중 하나라도 Fail
→ Fail로 판정

문제 정의

가정: 바코드를 통해 판단해야하는 기종을 알고 있음

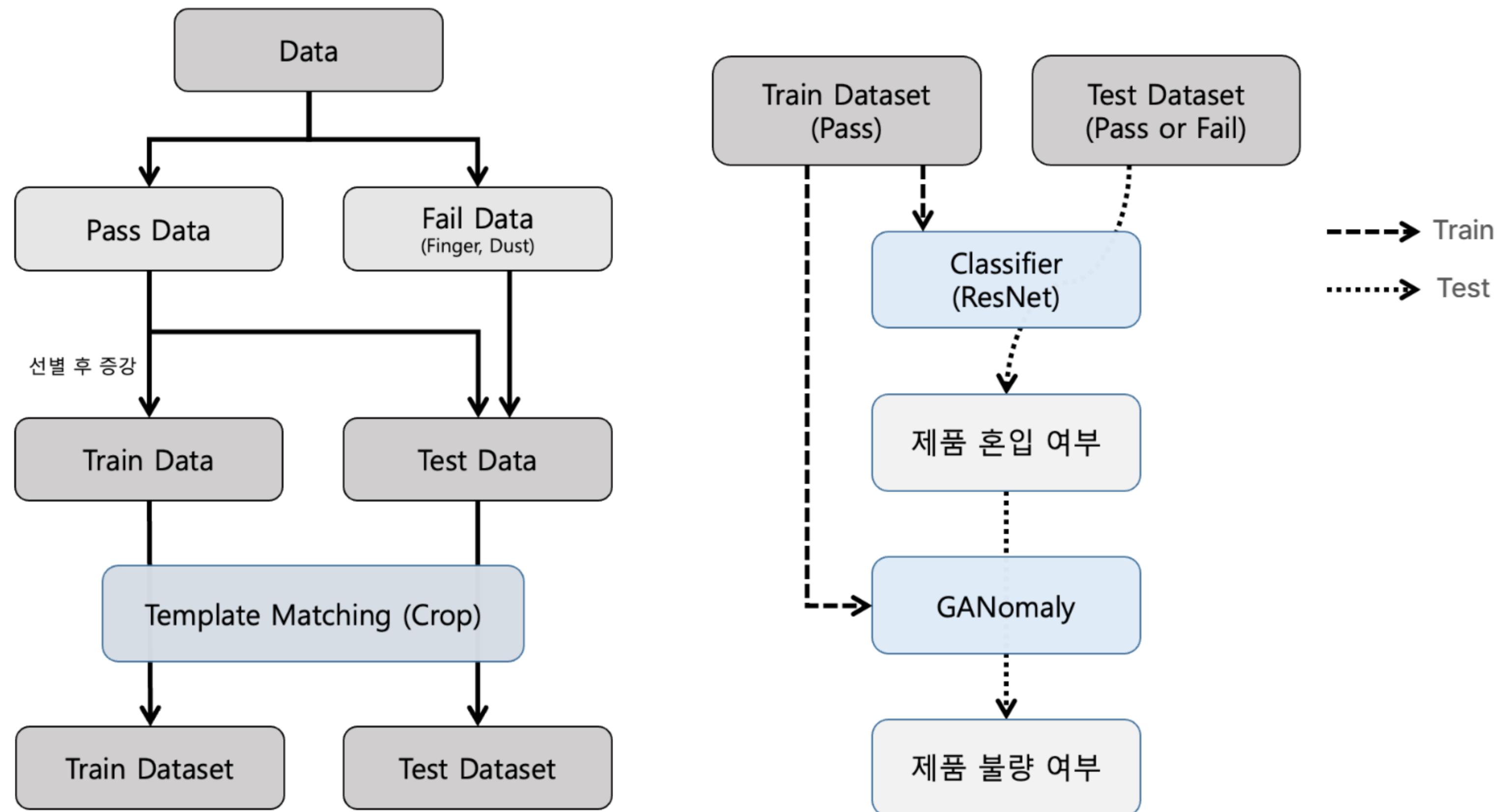
문제: 각 기종에 대해 올바른 언어 사용 및 ROI 영역 침범 여부



탬플릿 매칭 기반

딥러닝 기반

Overall Process

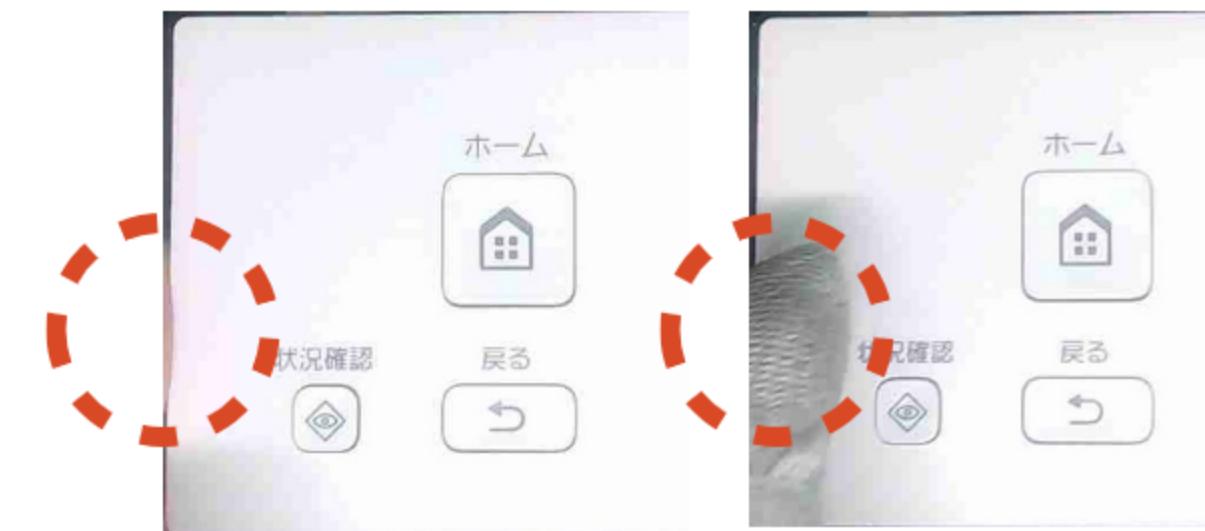


DATA

데이터셋 구성

[Data]

FM2-V160	3,962
FM2-V161	1,322
FM2-V162	7,636
FM2-V163	61
FM2-V164	20
FM2-V165	99
FM2-V166	5,037
FM2-V167	35



[Dust]



DATA

데이터셋 구성

- Pass 데이터 중 가장 정상성을 잘 반영한다고 판단된 이미지 선별(100장 / 12장) → Train set으로 구성



DATA

데이터셋 구성



Pass



Pass

Fail

[Augmentation]

FM2-V160
FM2-V161
FM2-V162
FM2-V166

100 → 1000 증강 (밝기/ 회전)

FM2-V163
FM2-V164
FM2-V165
FM2-V167

12 → 1000 증강 (밝기/ 회전/ 블러)

모델링

Crop

- Template Matching을 사용한 이미지 Crop
- 원본 이미지 - Grayscale - Canny Edge - Dilated - GaussianBlur

[Master Image]



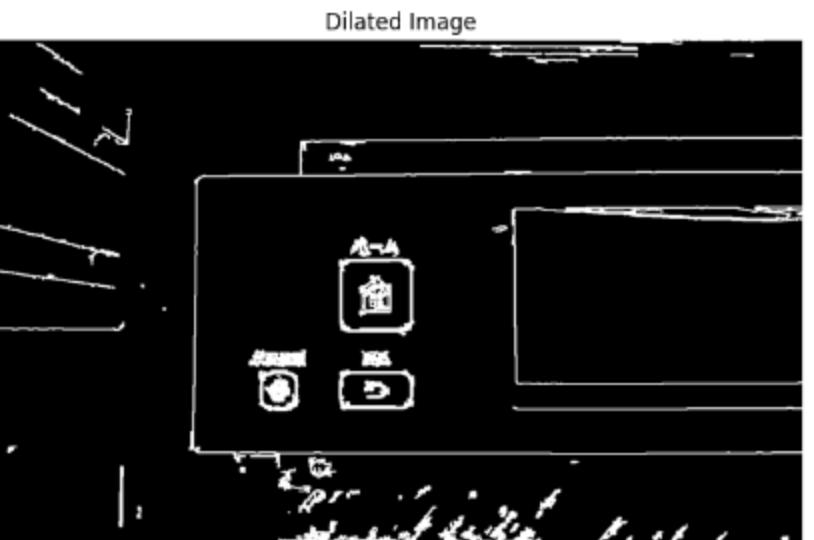
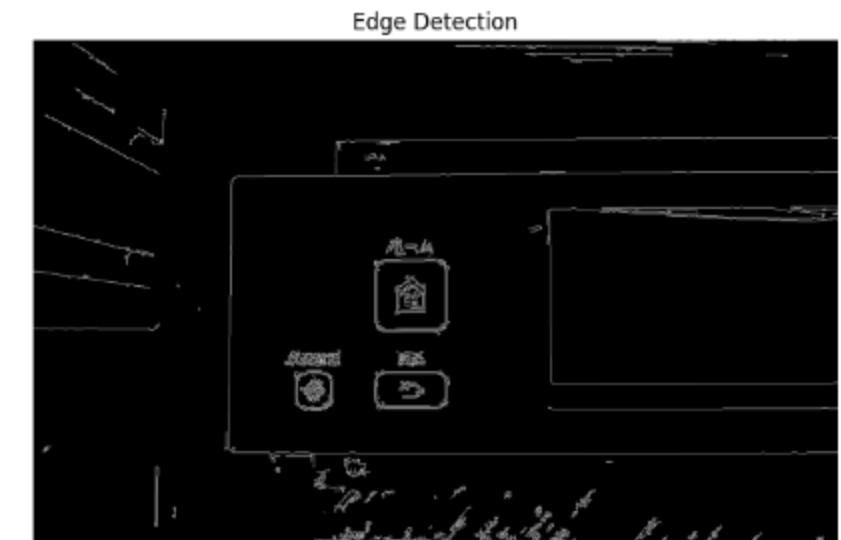
Template Preprocessed (Grayscale, Edge, Dilated, Blurred)



모델링

Crop

- 원본 이미지 - Grayscale - Canny Edge - Dilated - GaussianBlur



모델링

Crop

[Master Image]



Matched Region



Cropped Image

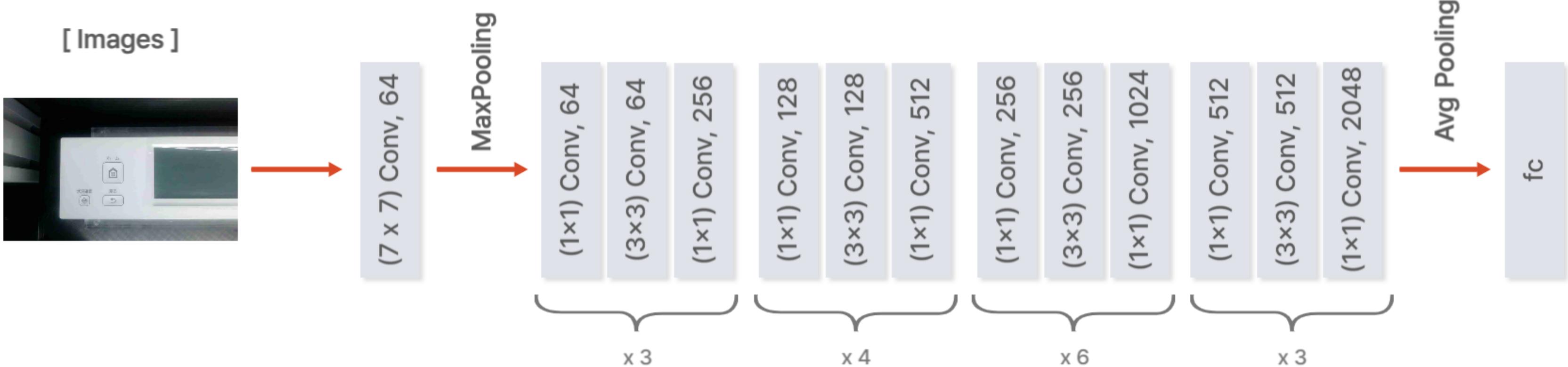


- 각 기종의 마스터 이미지(448 x 448)로 Template Matching을 사용한 이미지 crop

모델링

Classifier

- ResNet50 모델을 사용하여 기종을 8가지로 분류



- ResNet50 모델의 Fully Connected Layer를 클래스 수(8)로 변경하여 학습 진행

모델링

Classifier

[Test 데이터 결과]

Class	V160	V161	V162	V163	V164	V165	V166	V167
V160	3862	0	0	0	0	0	0	0
V161	0	1222	0	0	0	0	0	0
V162	0	0	7536	0	0	0	0	0
V163	0	0	0	45	0	0	0	0
V164	0	0	0	0	8	0	0	0
V165	0	0	0	0	0	86	0	0
V166	0	0	0	0	0	0	4936	0
V167	0	0	0	0	0	0	0	23

가정: 바코드를 통해 판단해야하는 기종을 알고 있음

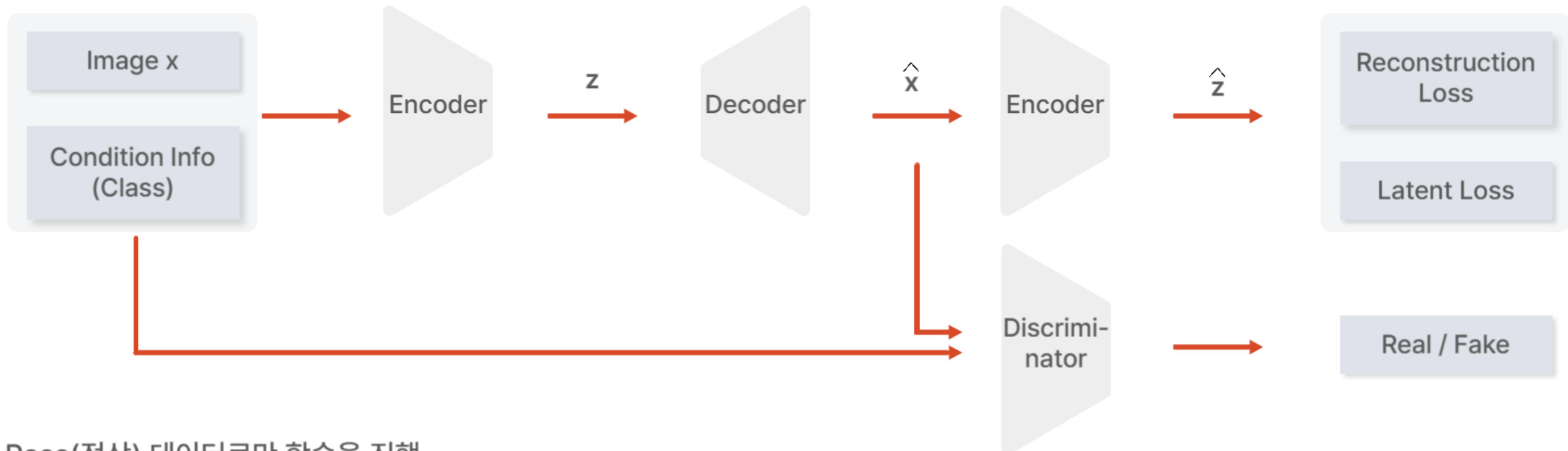
ResNet50 모델을 통한 입력 이미지 클래스 분류

- 예측된 기종이 현재 검사 기종과 동일한 경우 → Pass
- 예측된 기종이 현재 검사 기종과 다른 경우 → Fail

기종 혼입 탐지 가능

GANomaly

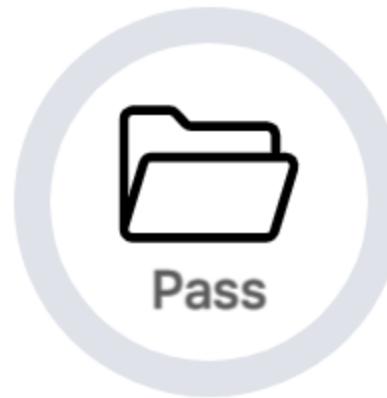
- Reconstruction Error와 Latent Error를 사용하여 Pass/ Fail 구분



- Pass(정상) 데이터로만 학습을 진행
- Test 단계에서 Reconstruction Error와 Latent Error를 기반으로 이상 이미지를 식별

모델링

GANomaly



Reconstruction
Error

0.0065

Latent Error

0.0802



Reconstruction
Error

0.0314

Latent Error

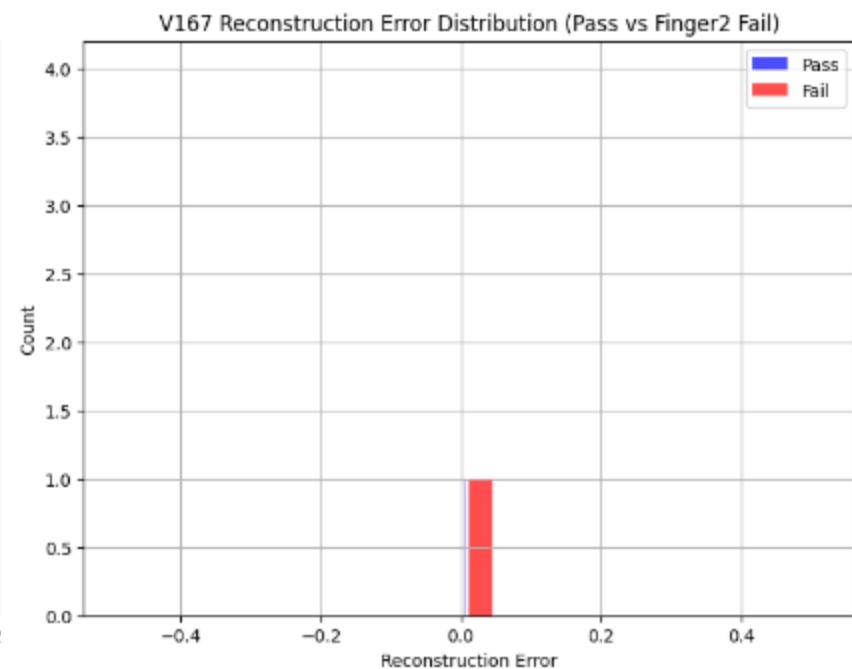
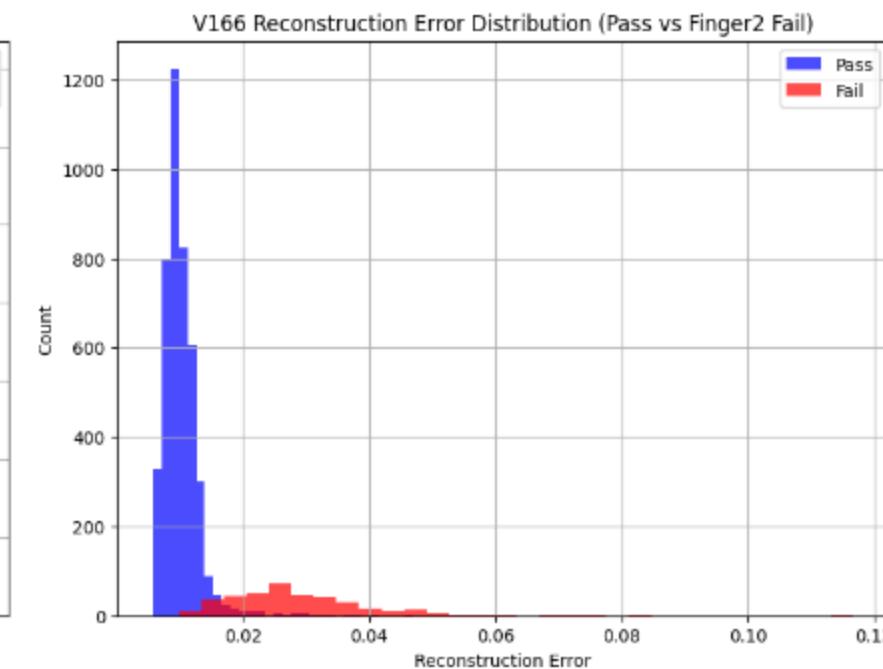
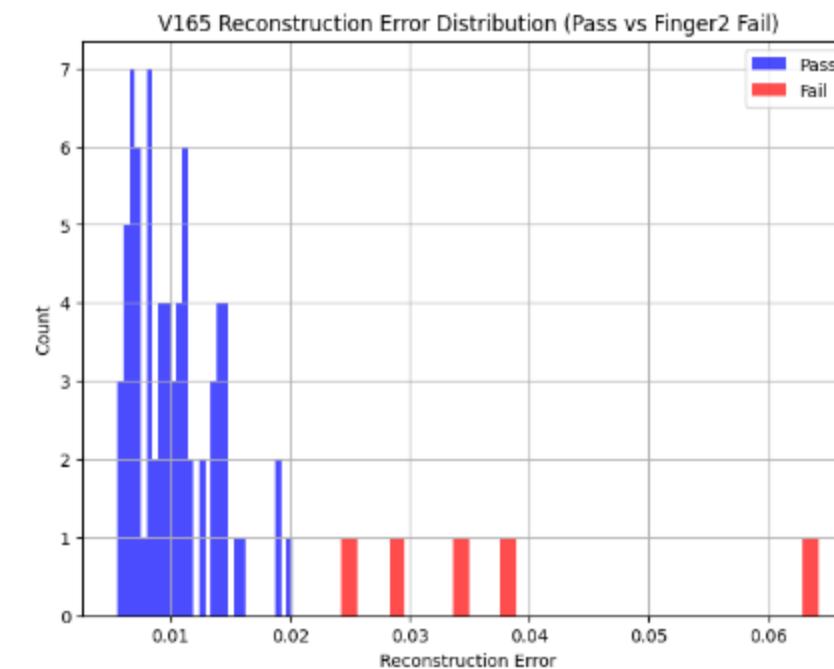
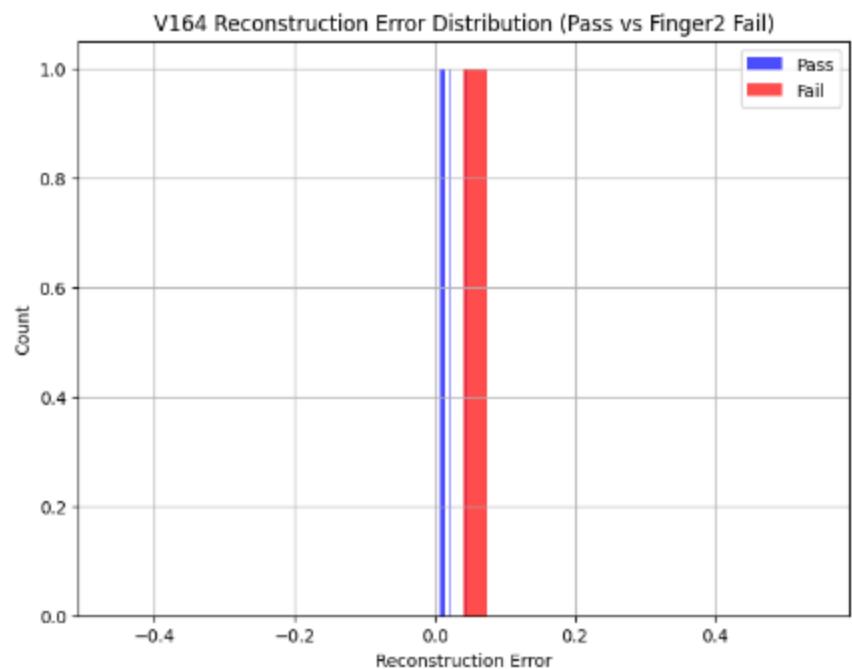
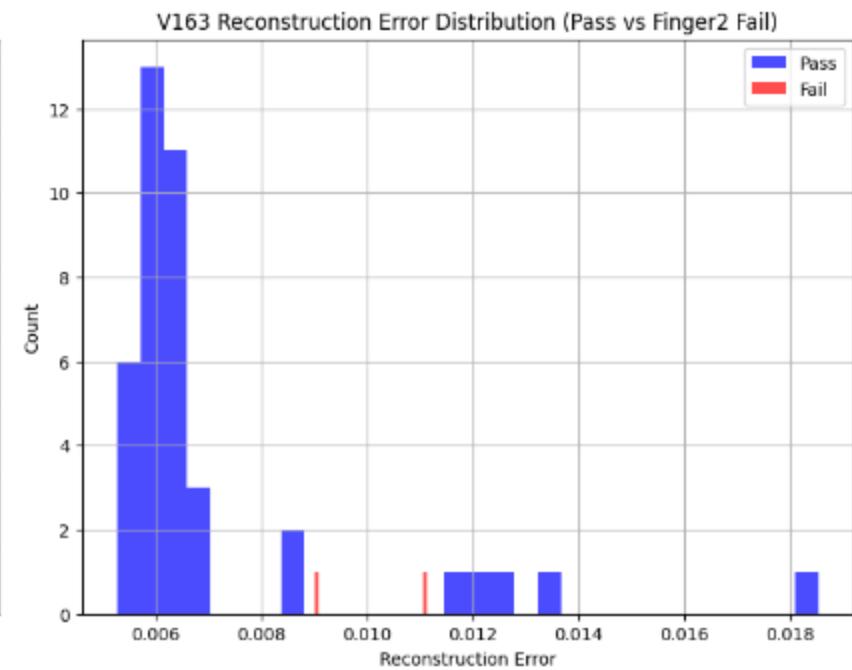
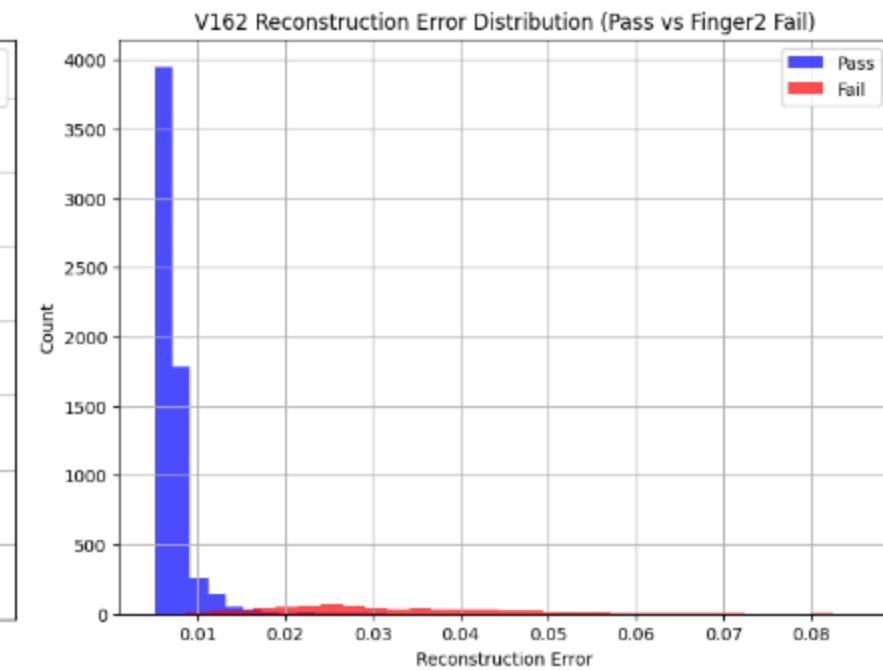
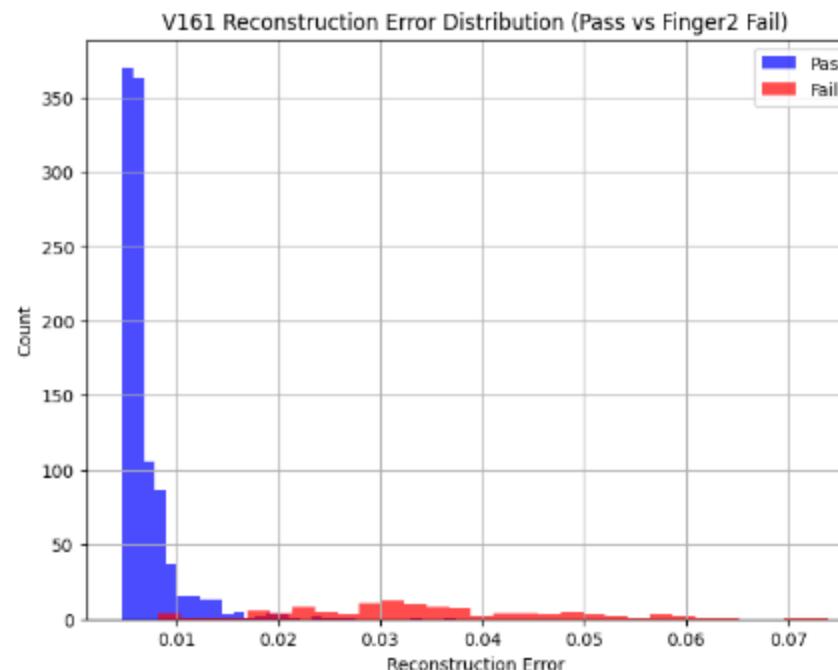
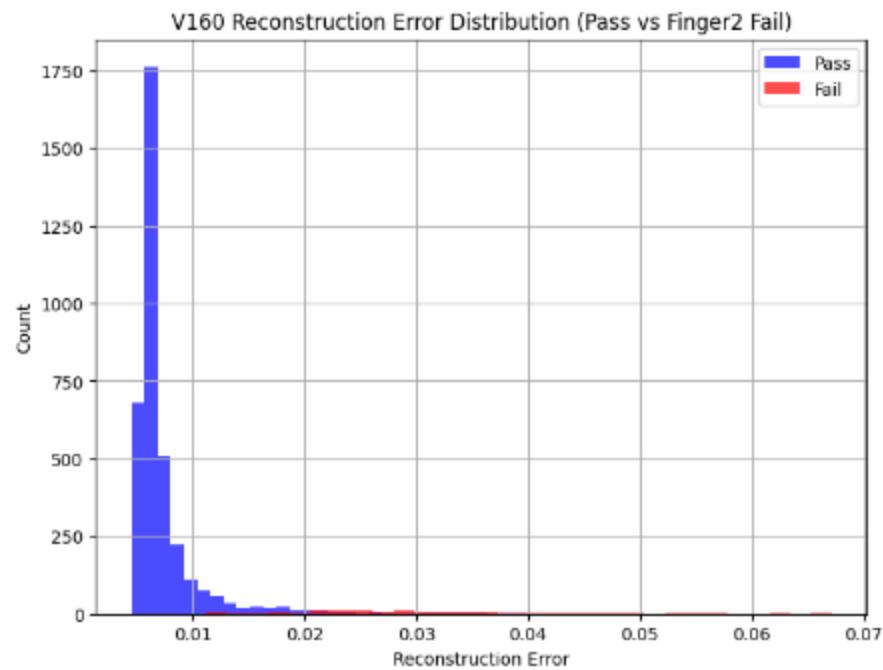
0.3084

결과

잠재 공간 크기

128

Reconstruction Error

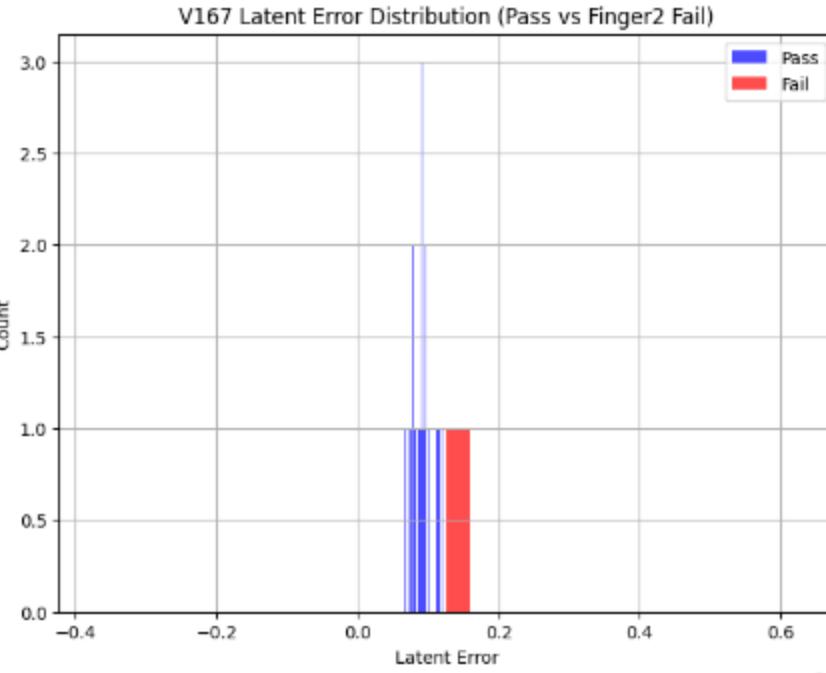
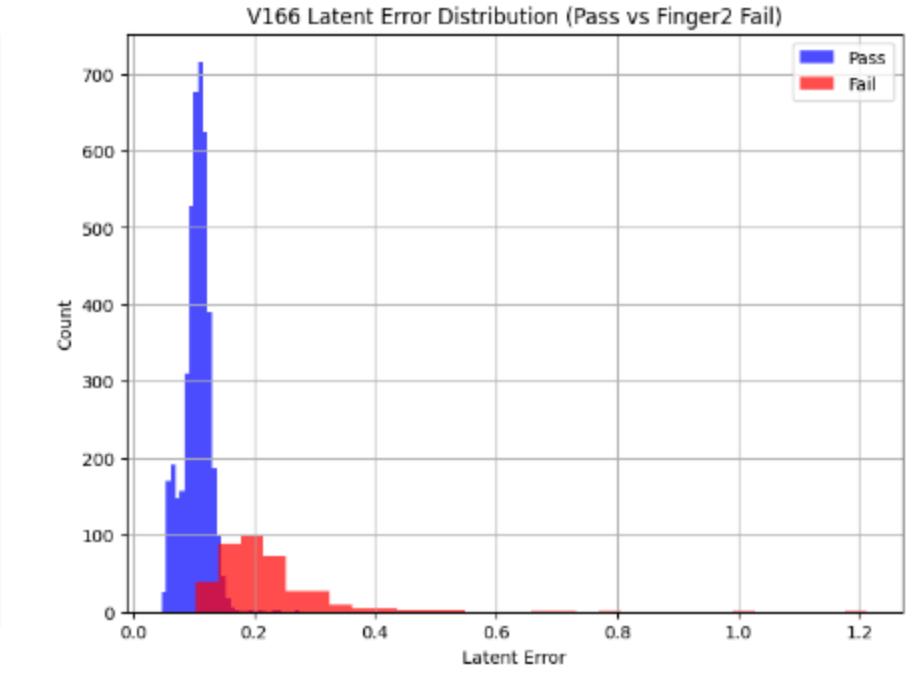
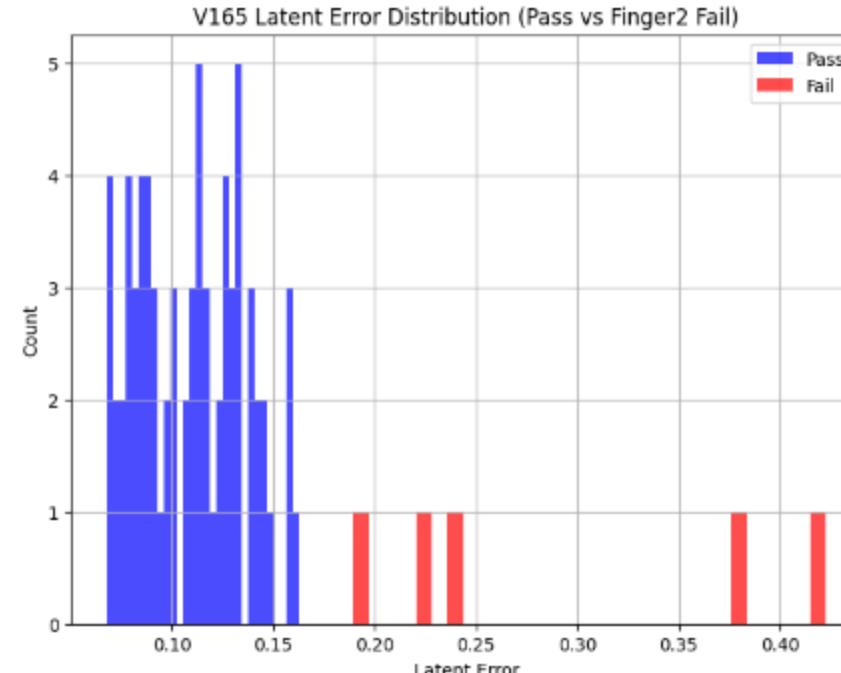
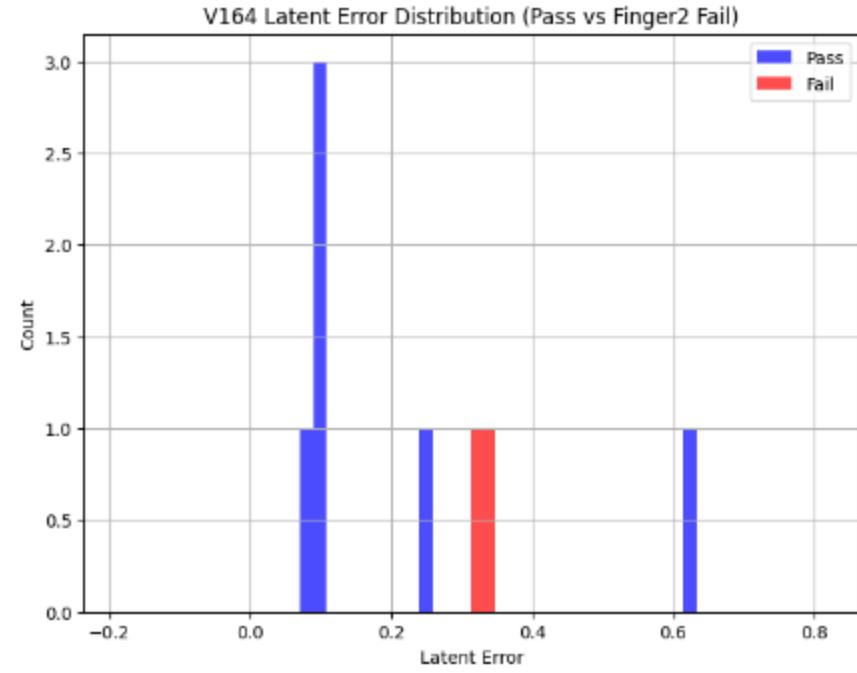
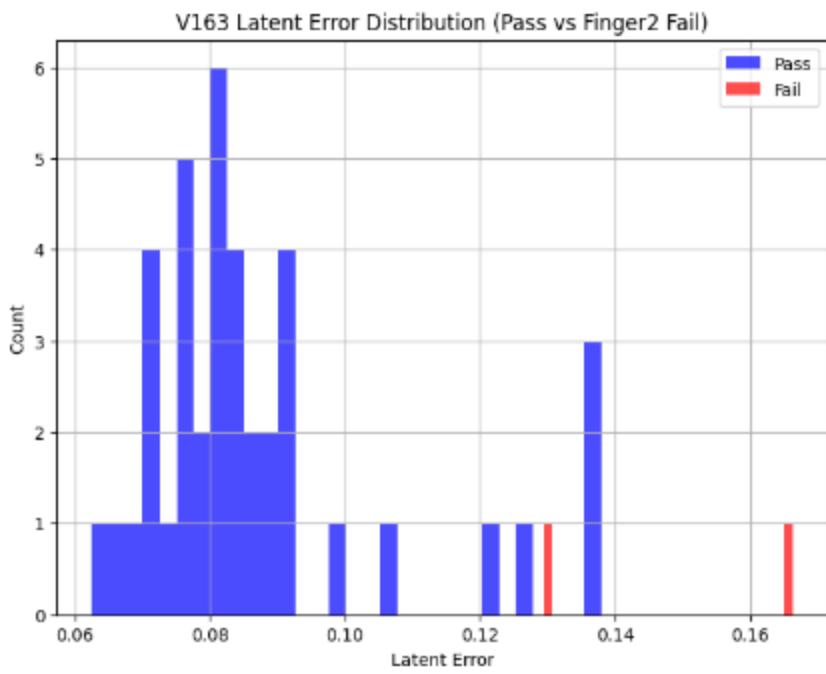
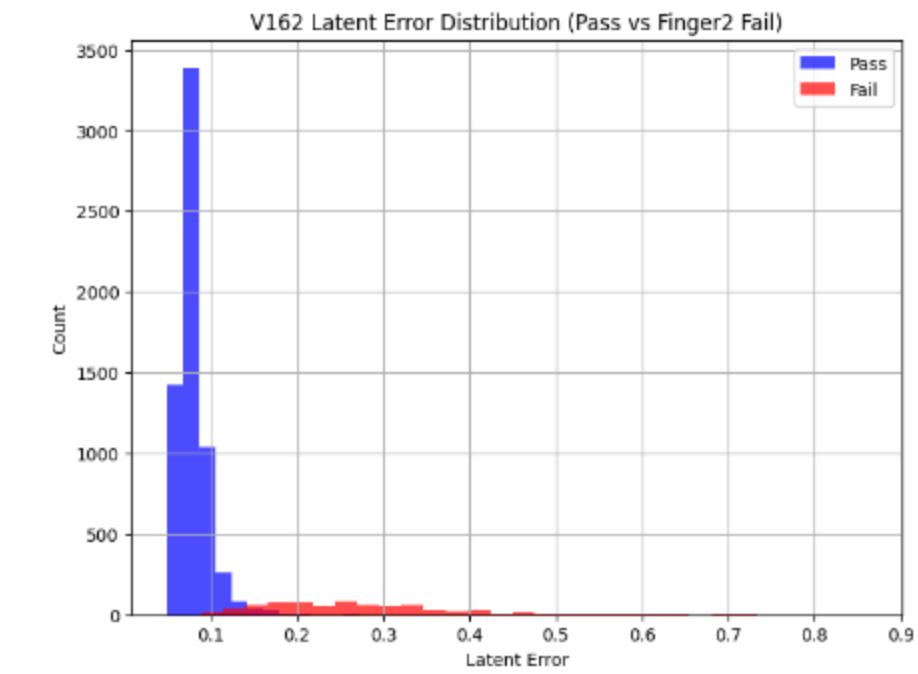
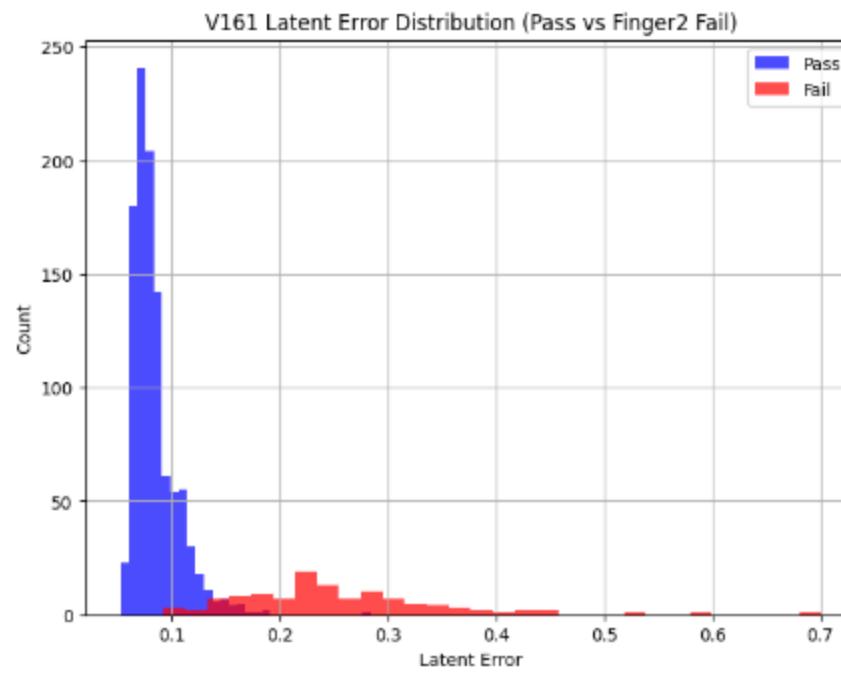
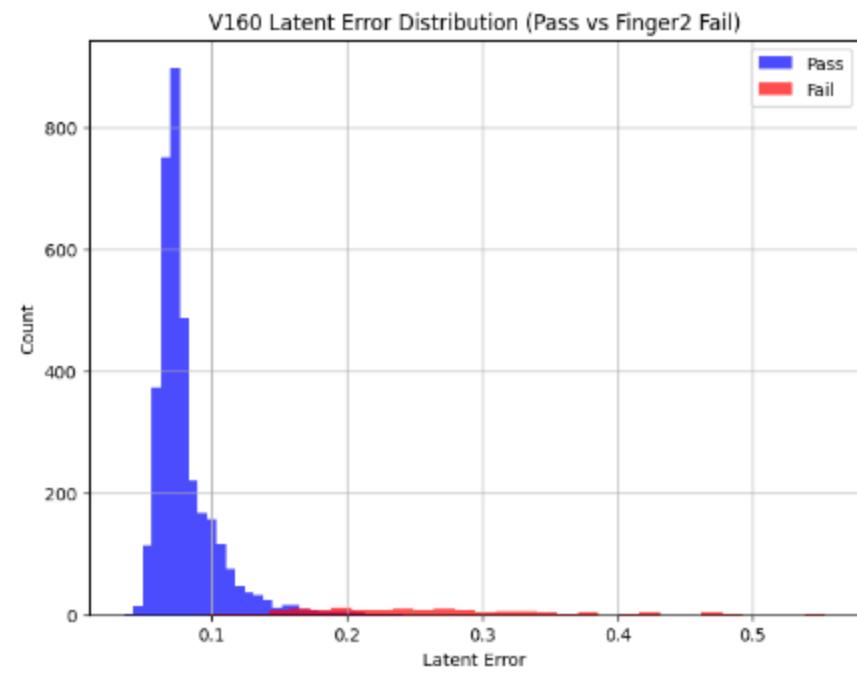


결과

잠재 공간 크기

128

Latent Error

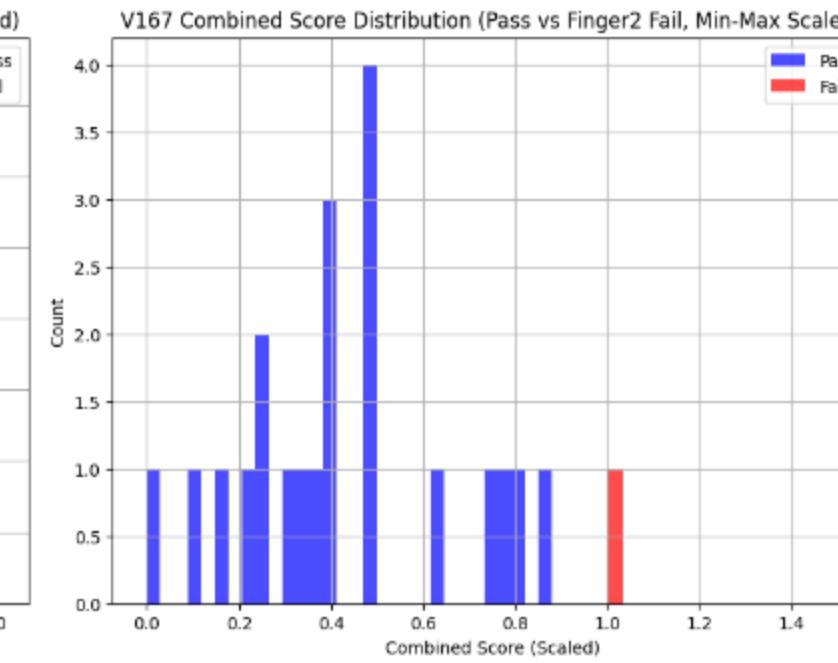
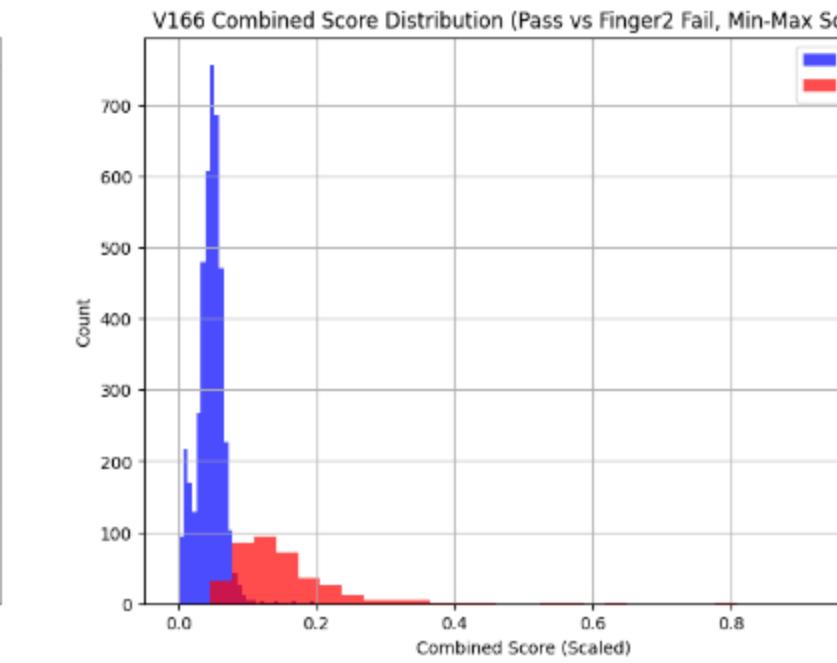
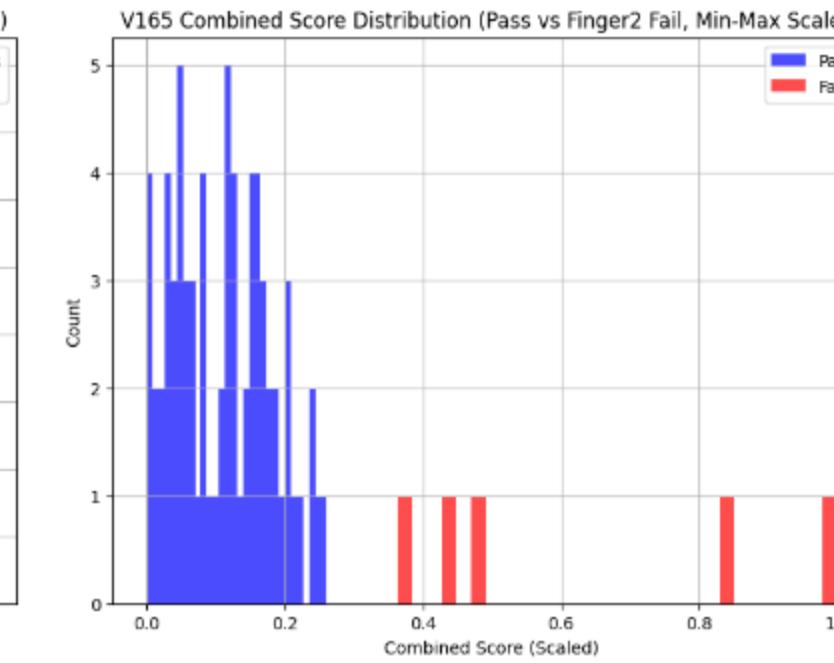
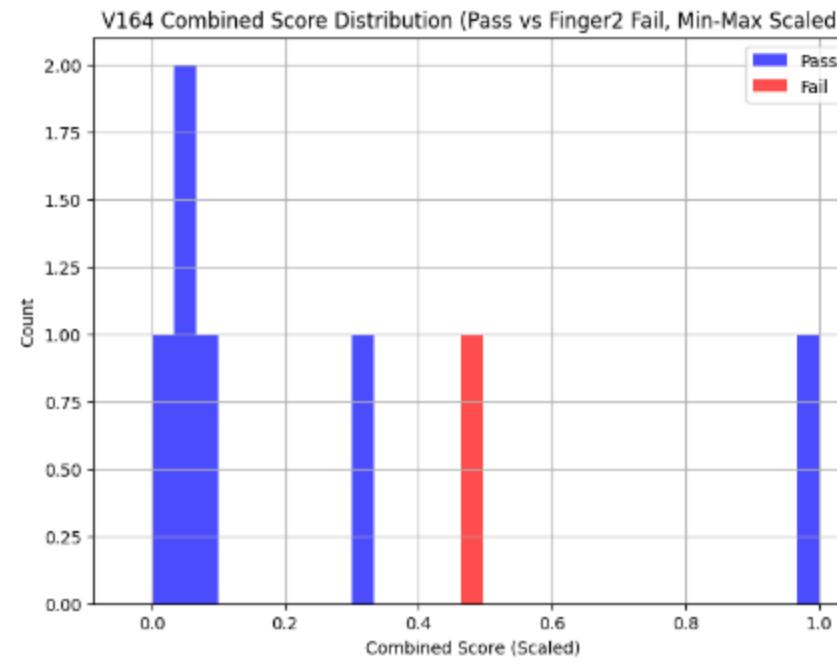
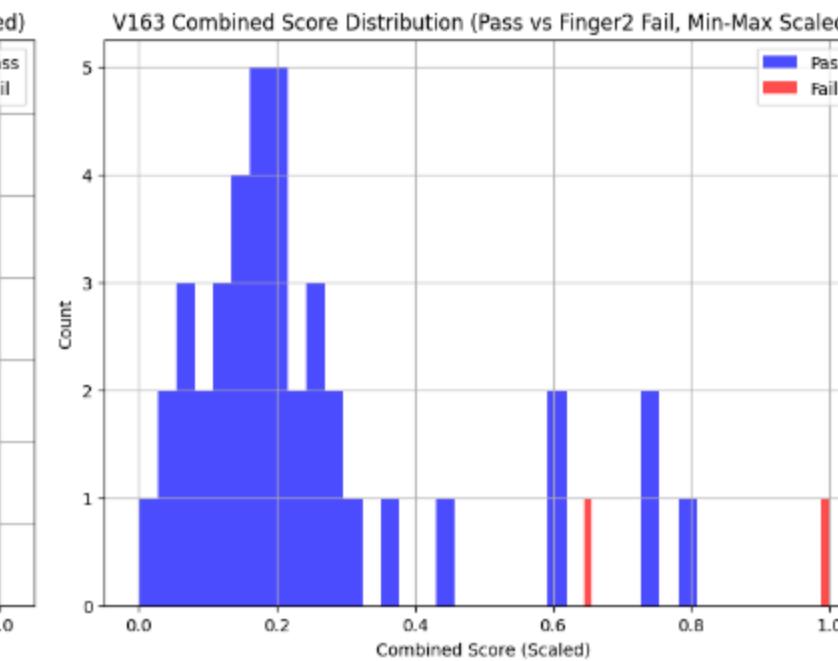
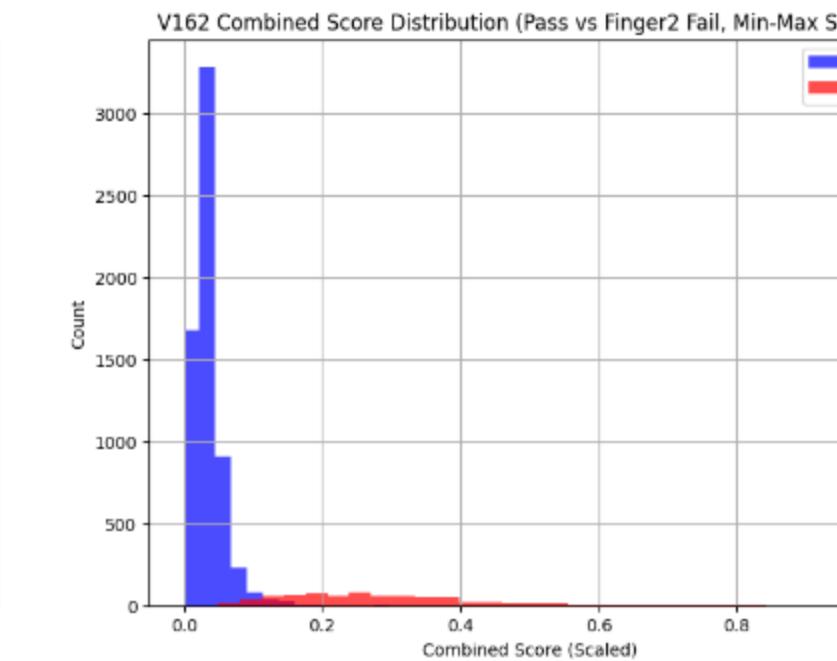
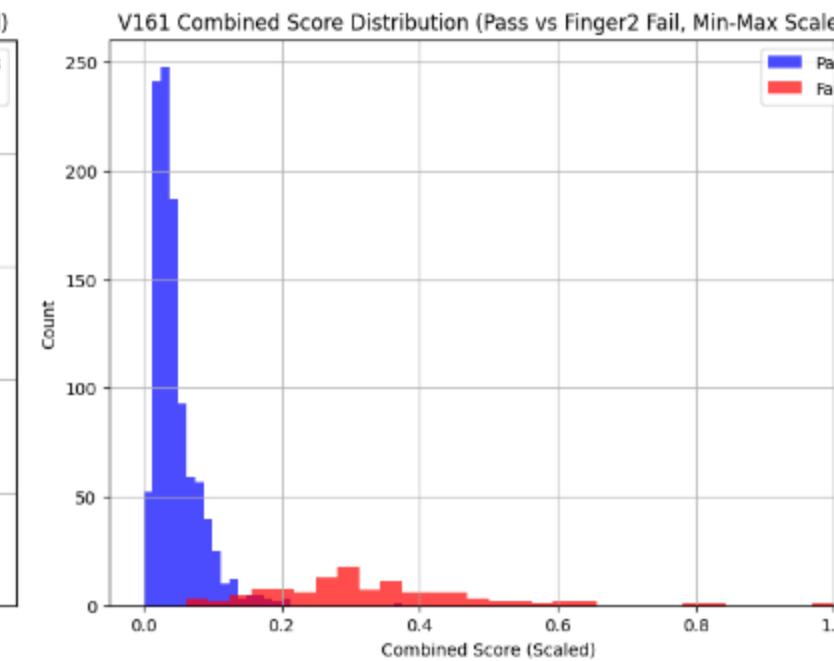
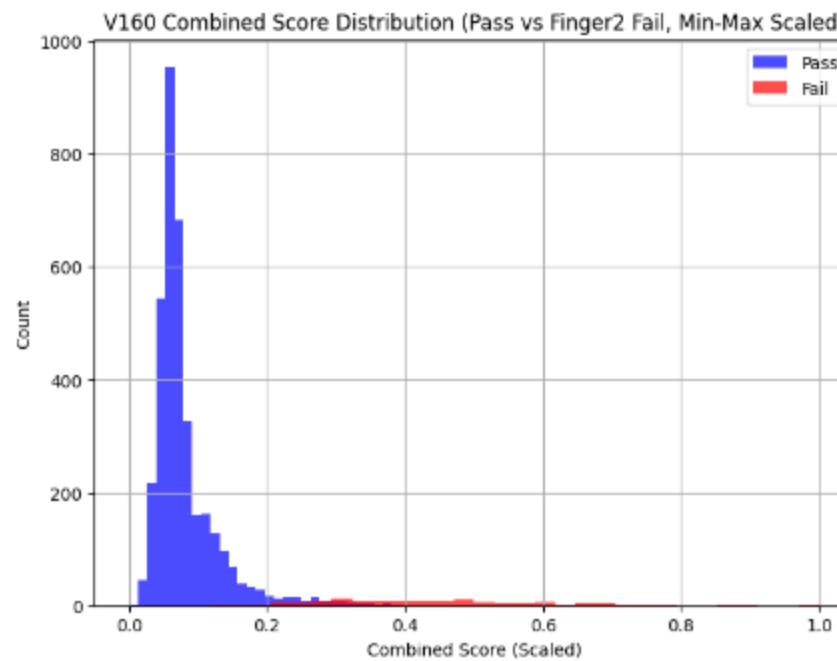


결과

잠재 공간 크기

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Combined Score



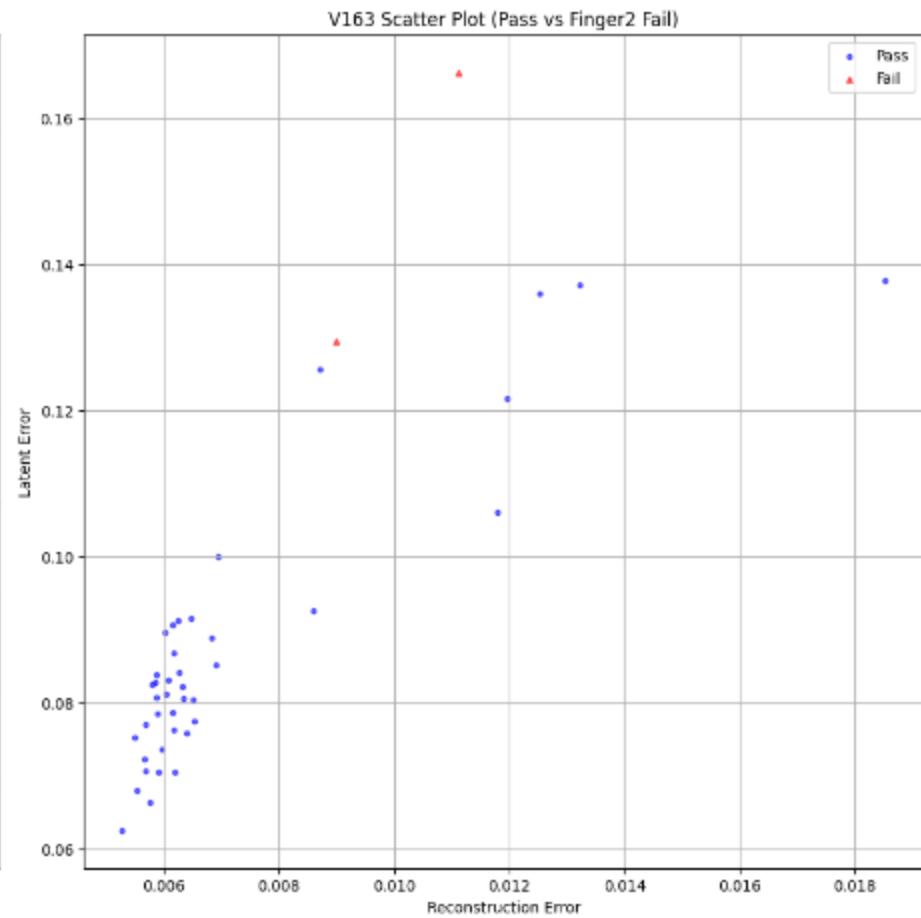
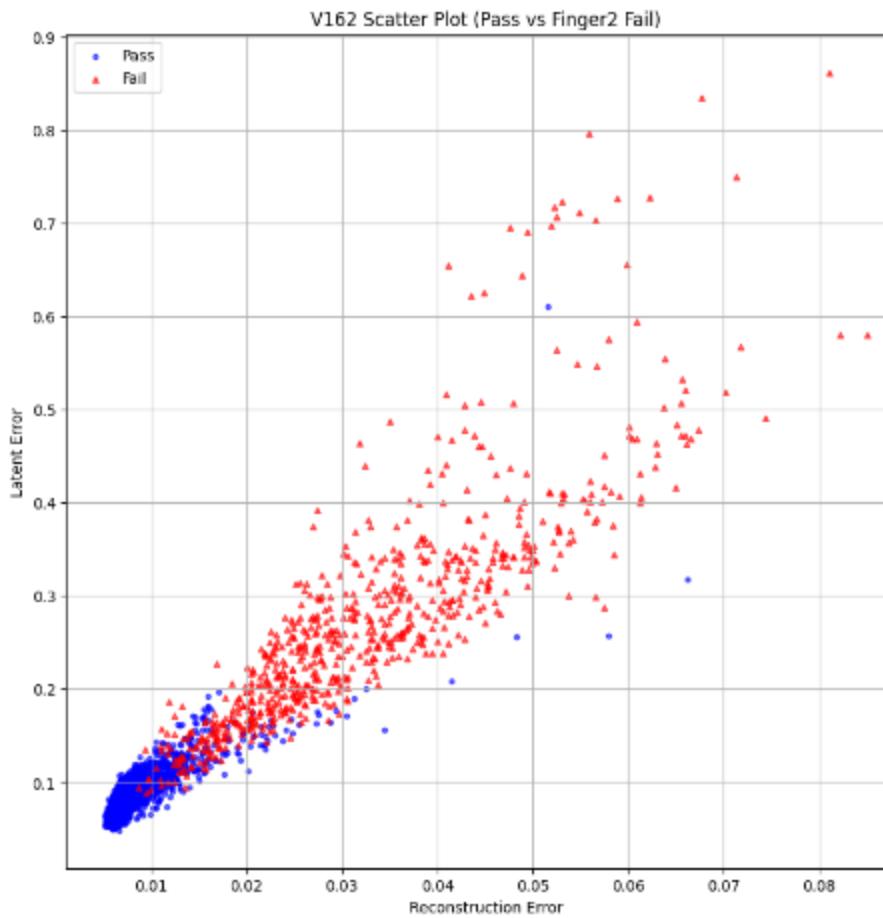
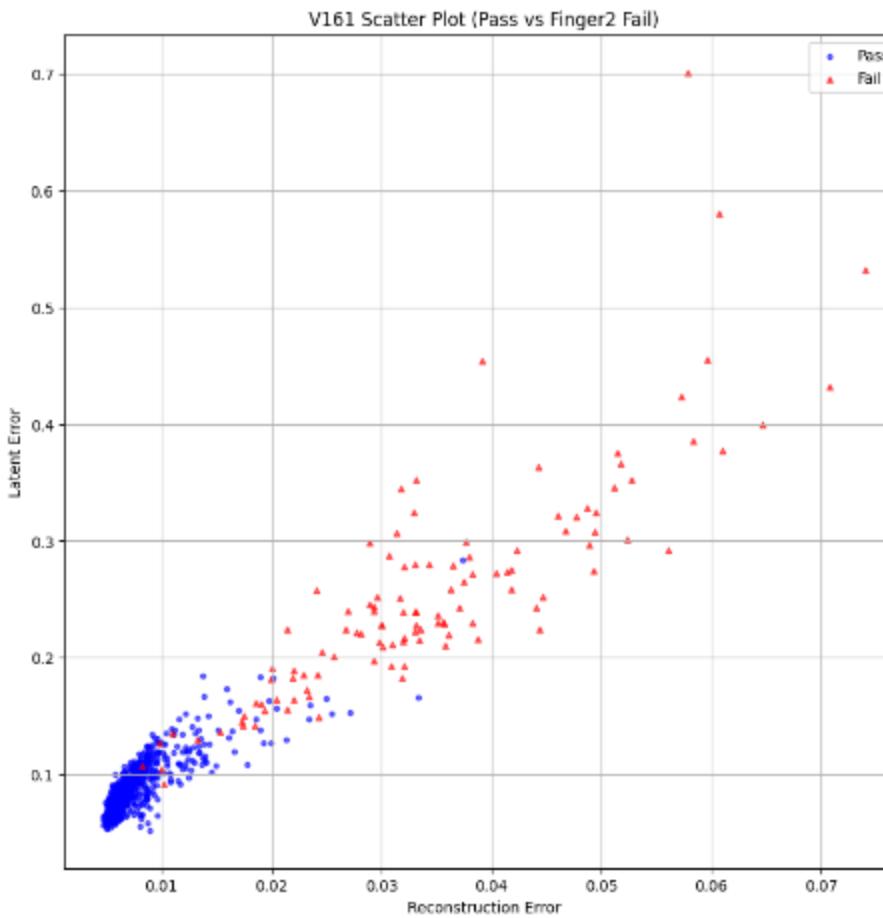
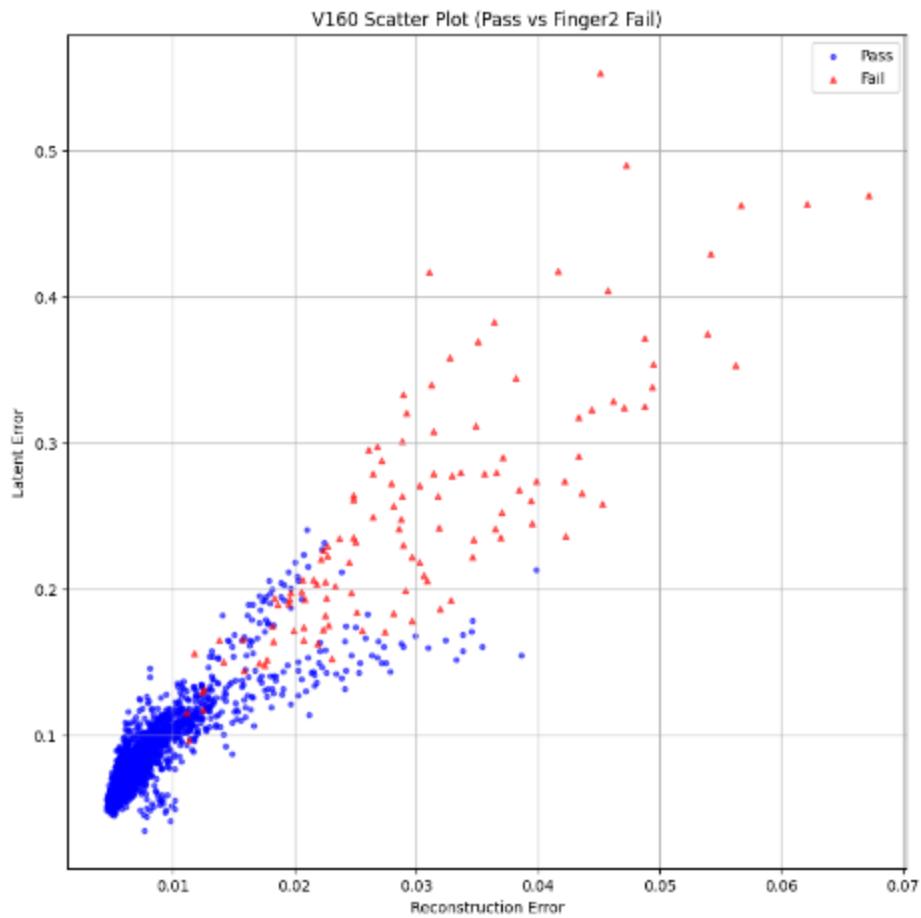
결과

잠재 공간 크기

128

Scatter Plot (Finger2)

- x : Reconstruction Error
- y : Latent Error



V160

V161

V162

V163

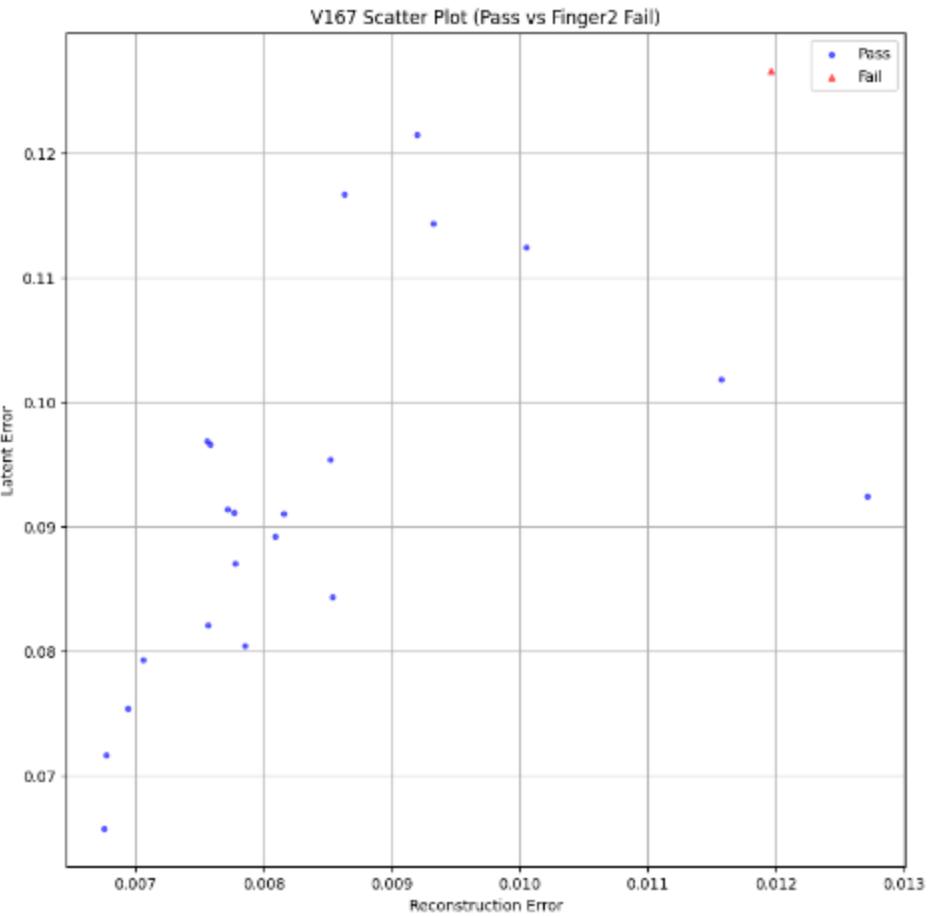
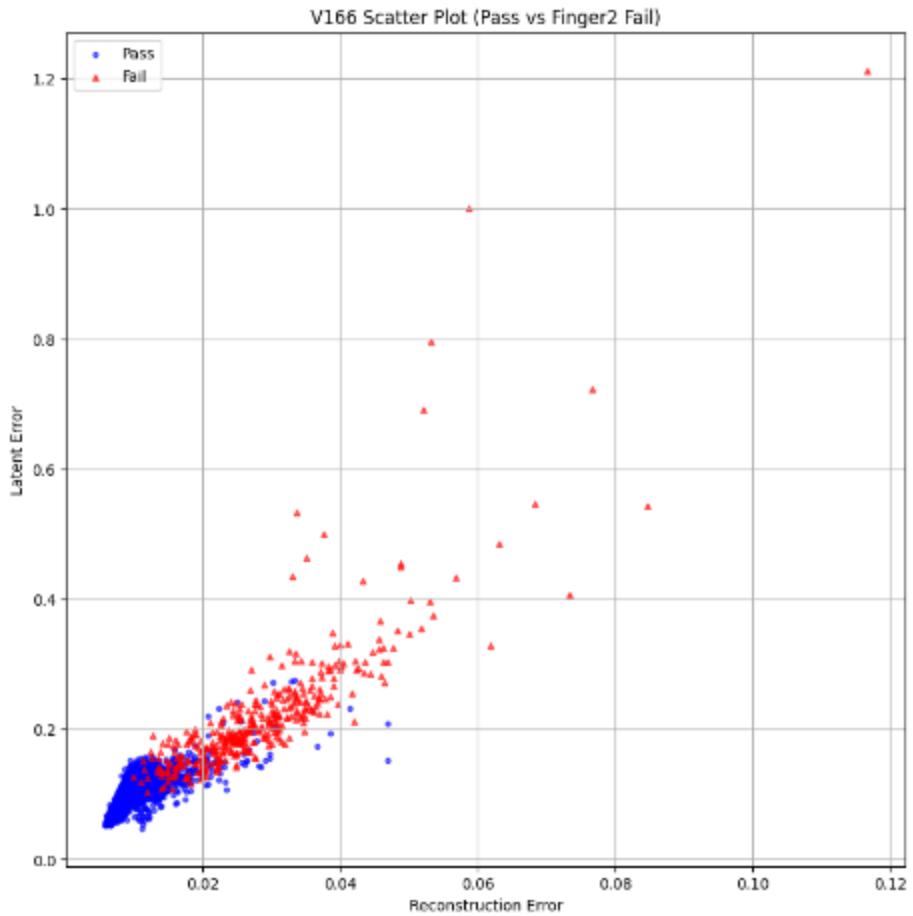
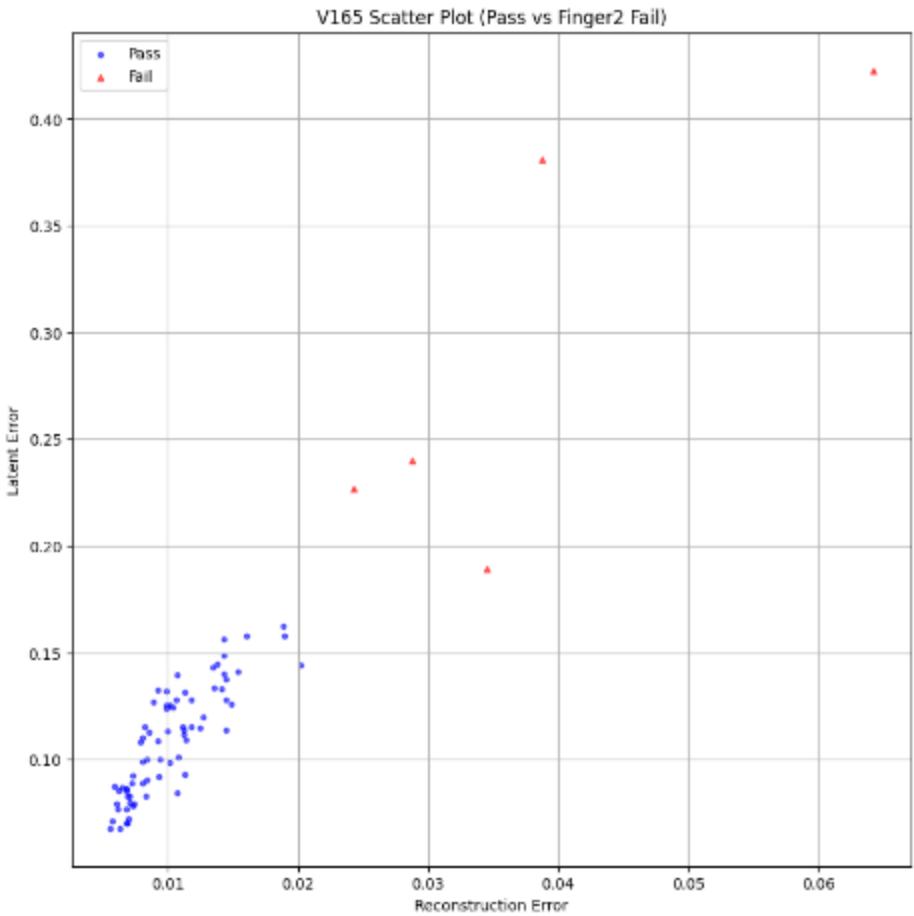
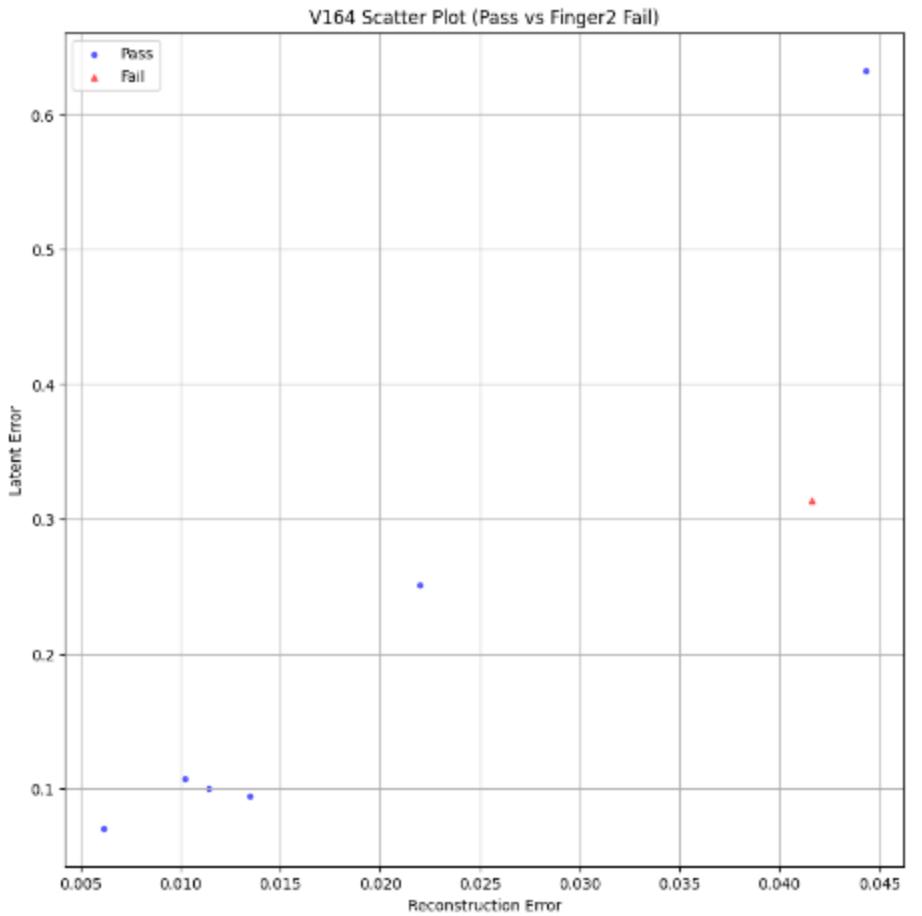
결과

잠재 공간 크기

128

Scatter Plot (Finger2)

- x : Reconstruction Error
- y : Latent Error



V164

V165

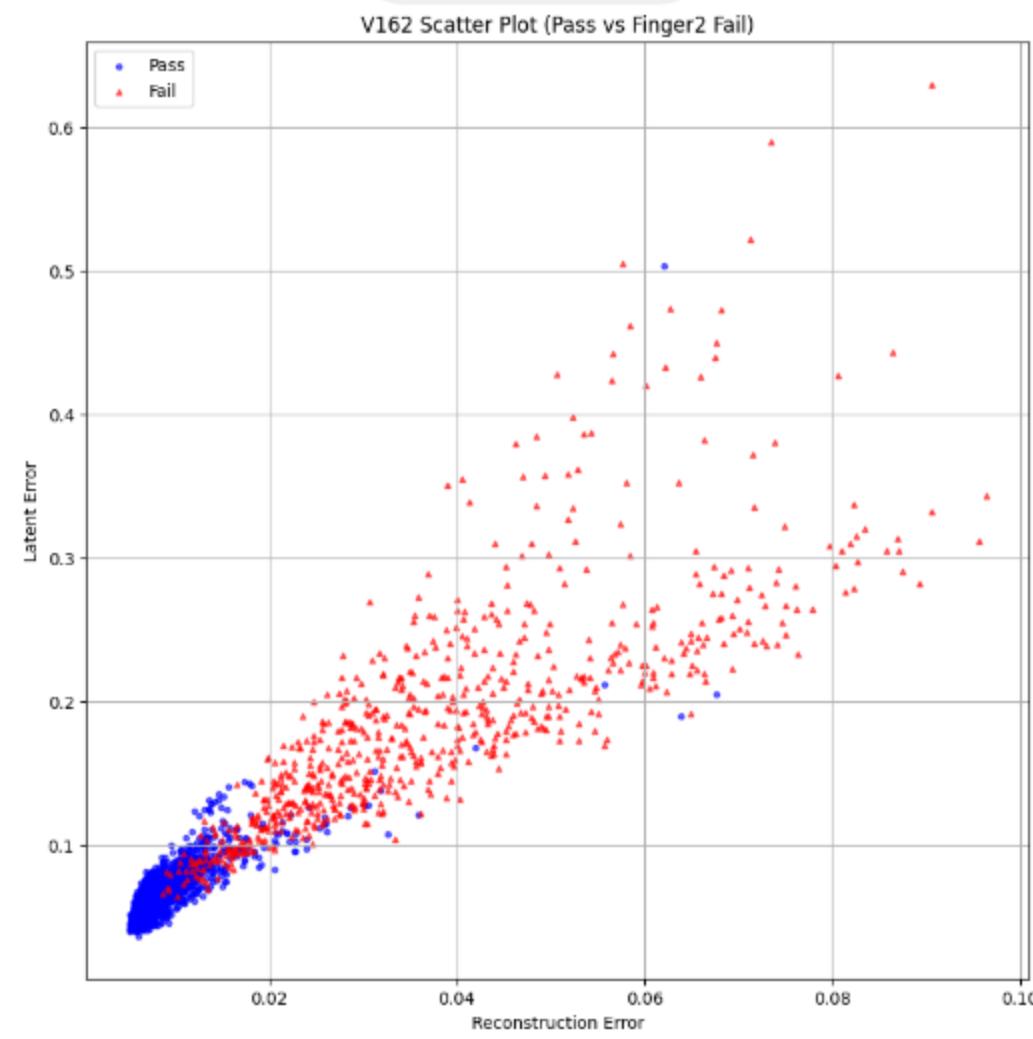
V166

V167

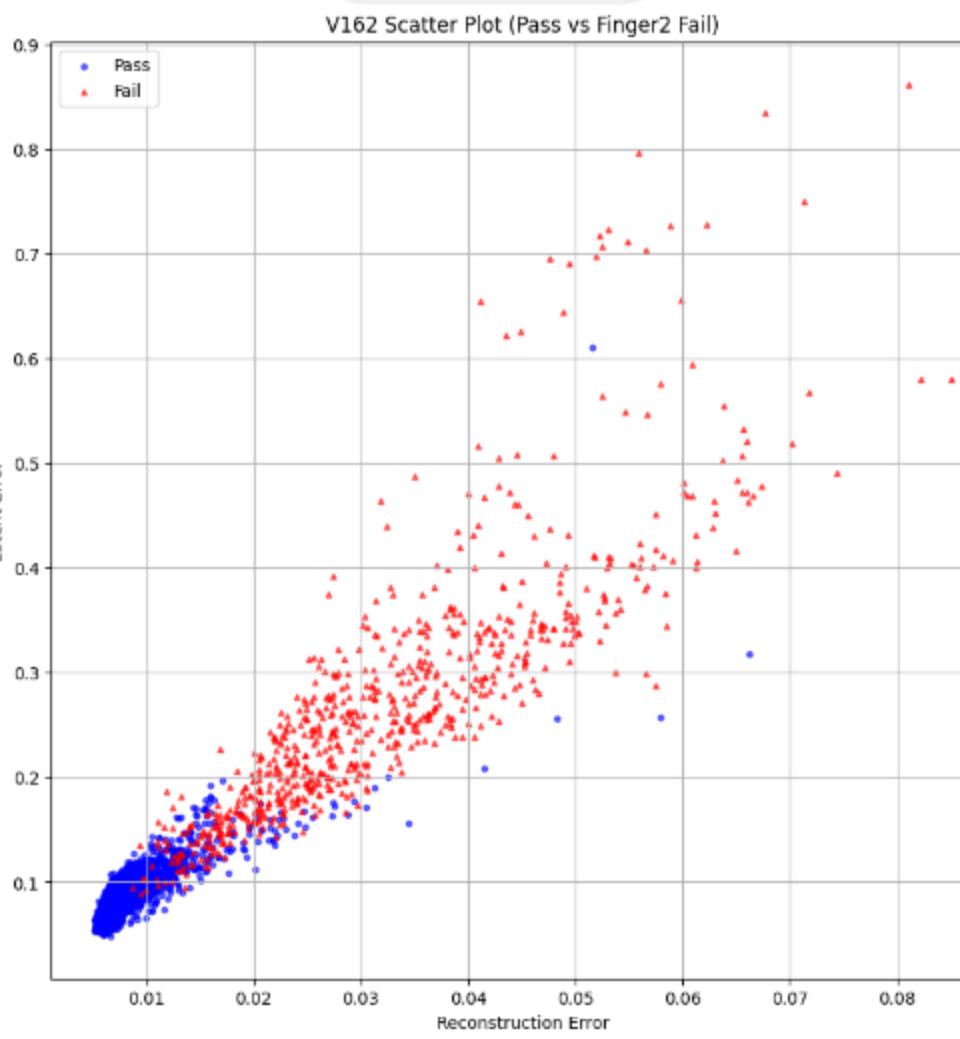
모델링

GANomaly

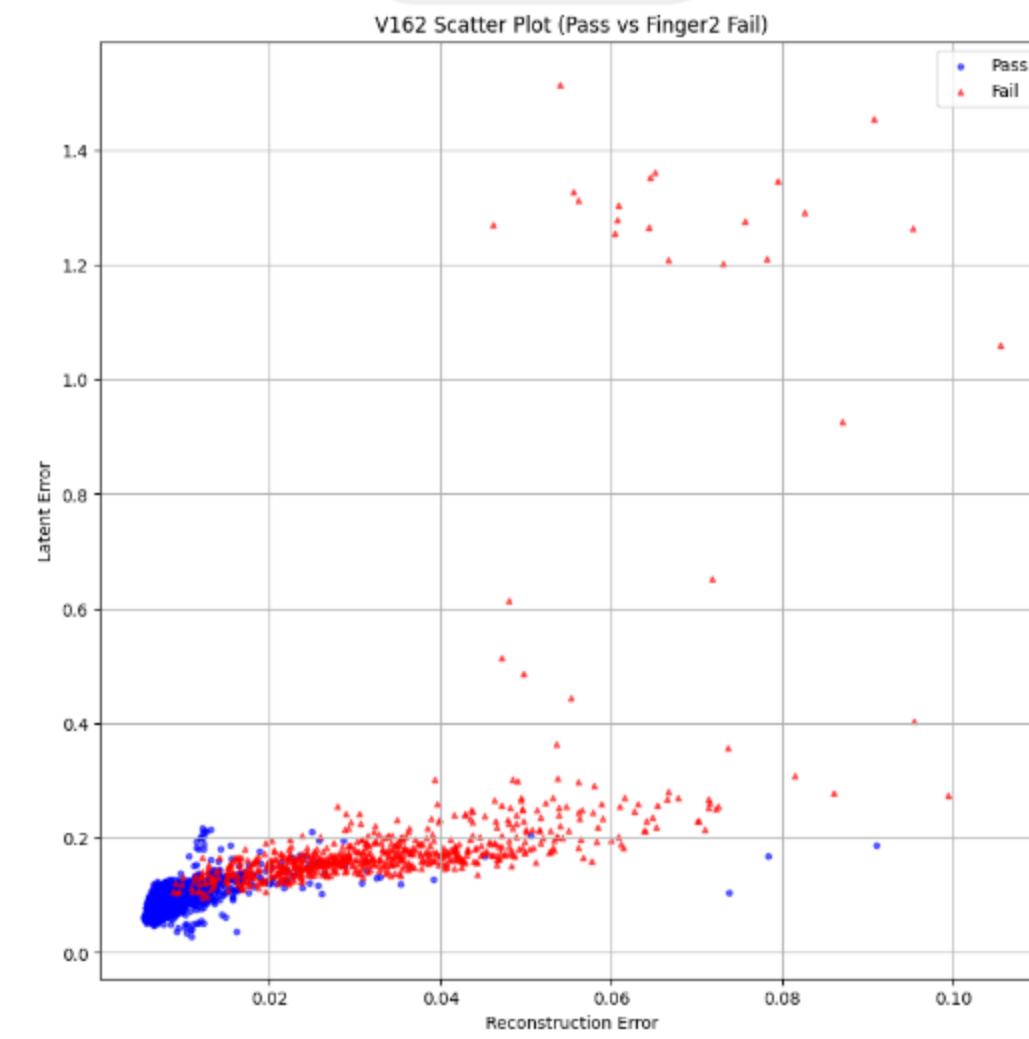
256



128



64



결과

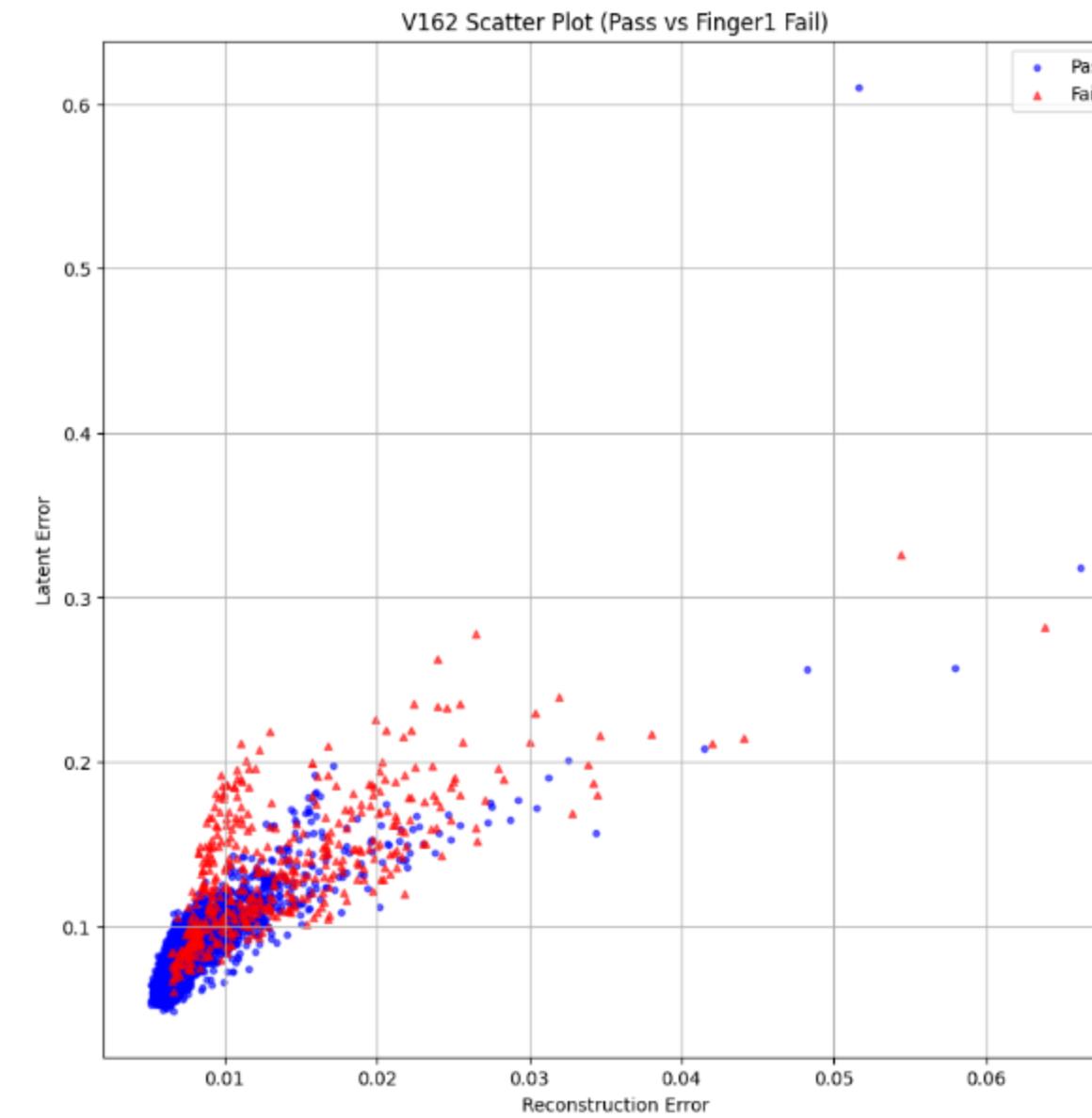
잠재 공간 크기

128

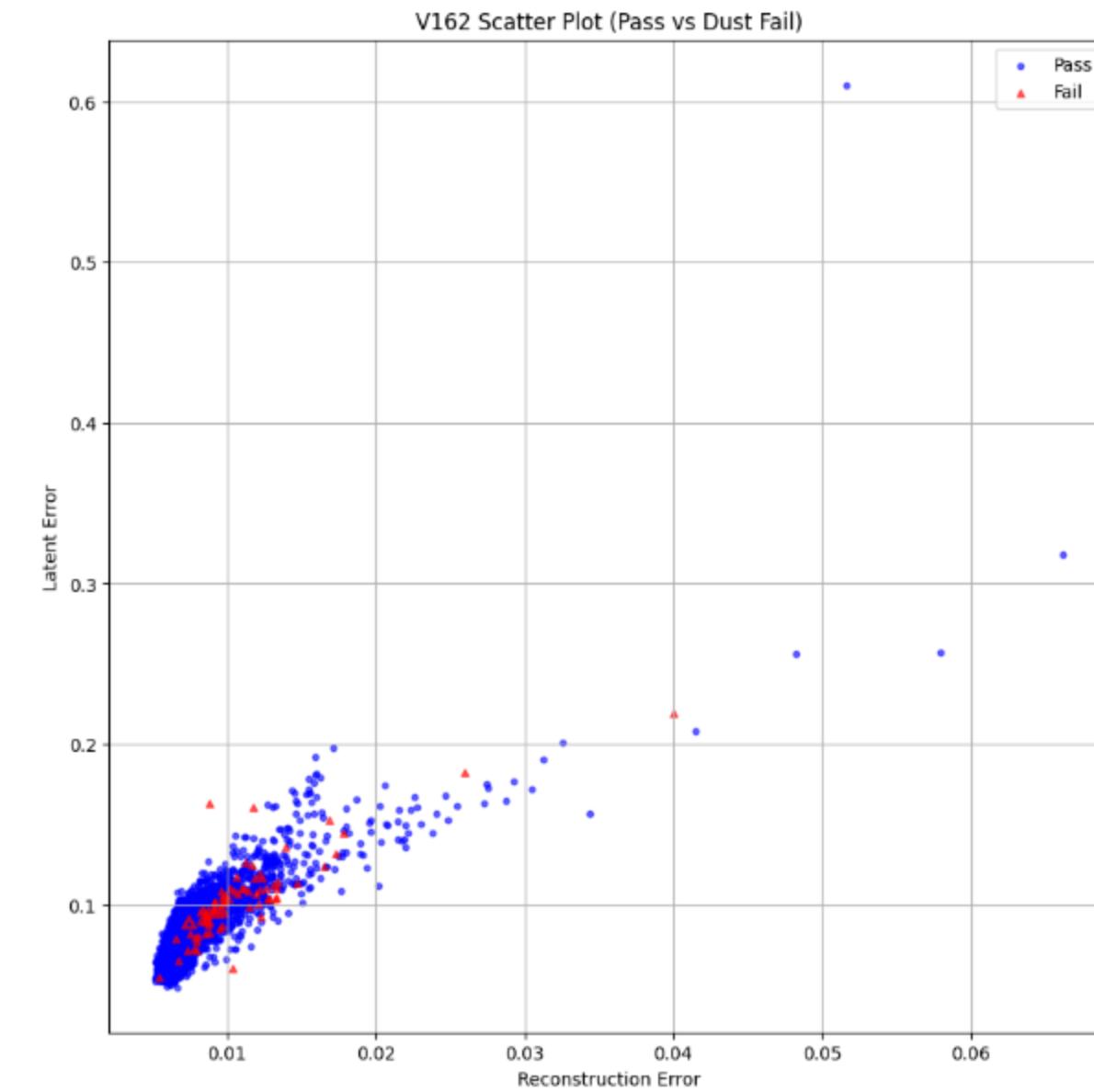
Scatter Plot (V162)

- x : Reconstruction Error
- y : Latent Error

Finger 1



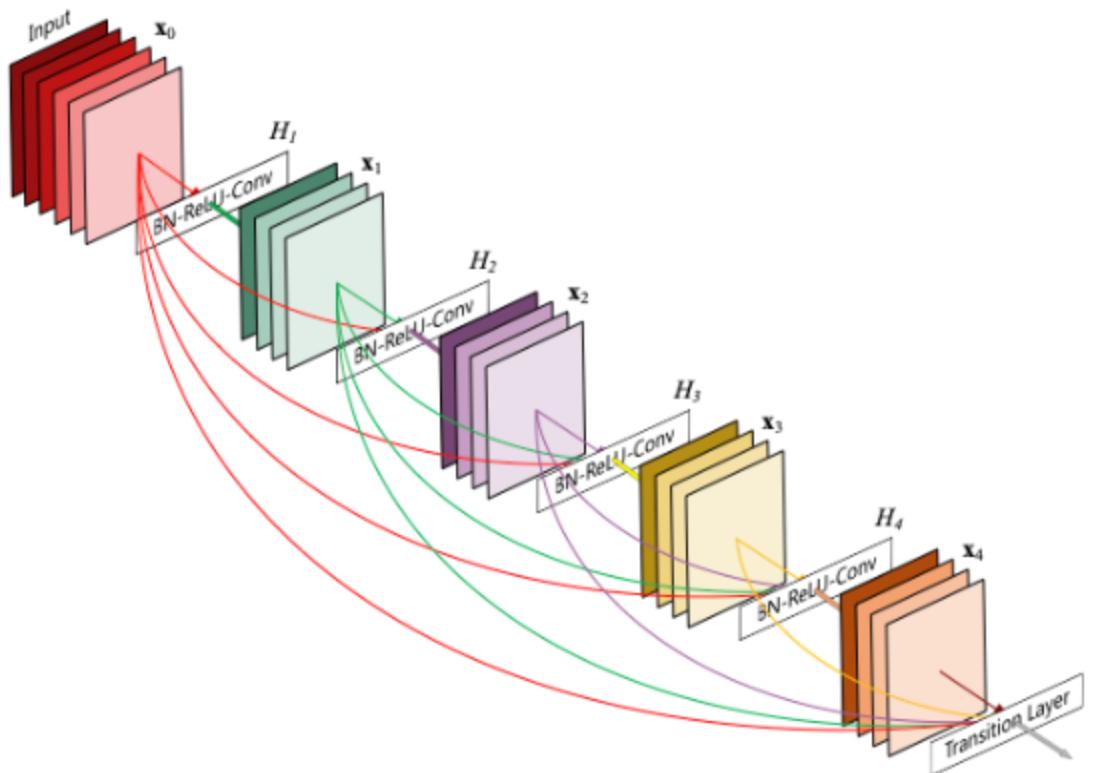
Dust



모델링

DenseNet

- 사전학습된 DenseNet 121 모델을 사용하여 Pass / Fail 분류
 - 각 레이어가 이후 모든 레이어와 직접 연결
 - 특징 맵을 레이어 간에 효율적으로 공유



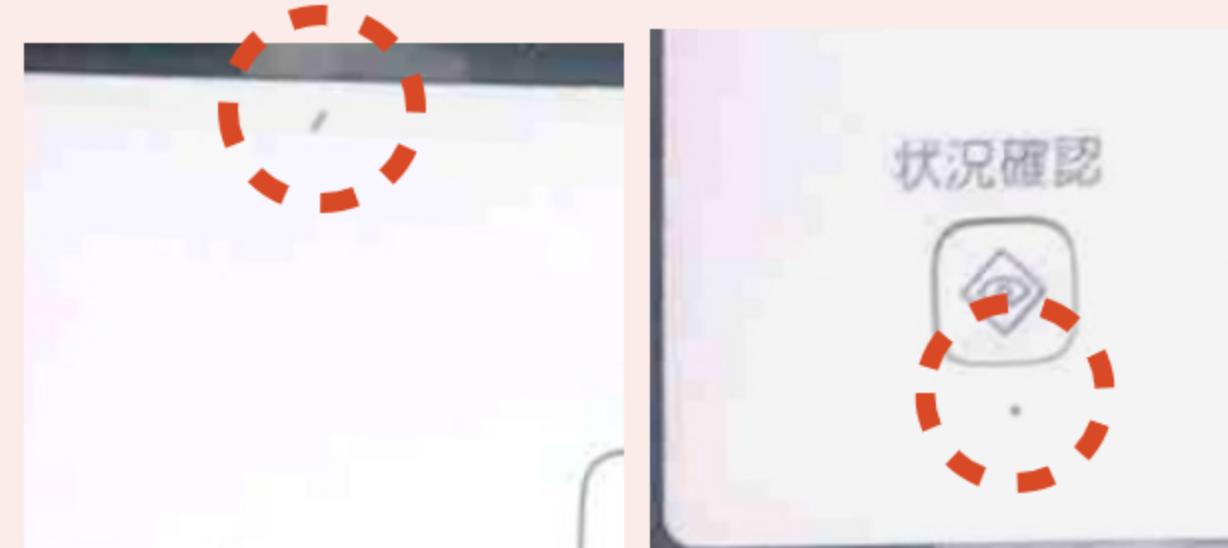
- FC 레이어를 2 클래스(Pass / Fail)로 변경

[FM2-V160]



Pass

Fail



- ROI 영역에 노이즈(먼지와 선)를 추가하여 데이터 증강
- Fail 이미지를 인위적으로 생성하여 모델 학습에 사용

결과

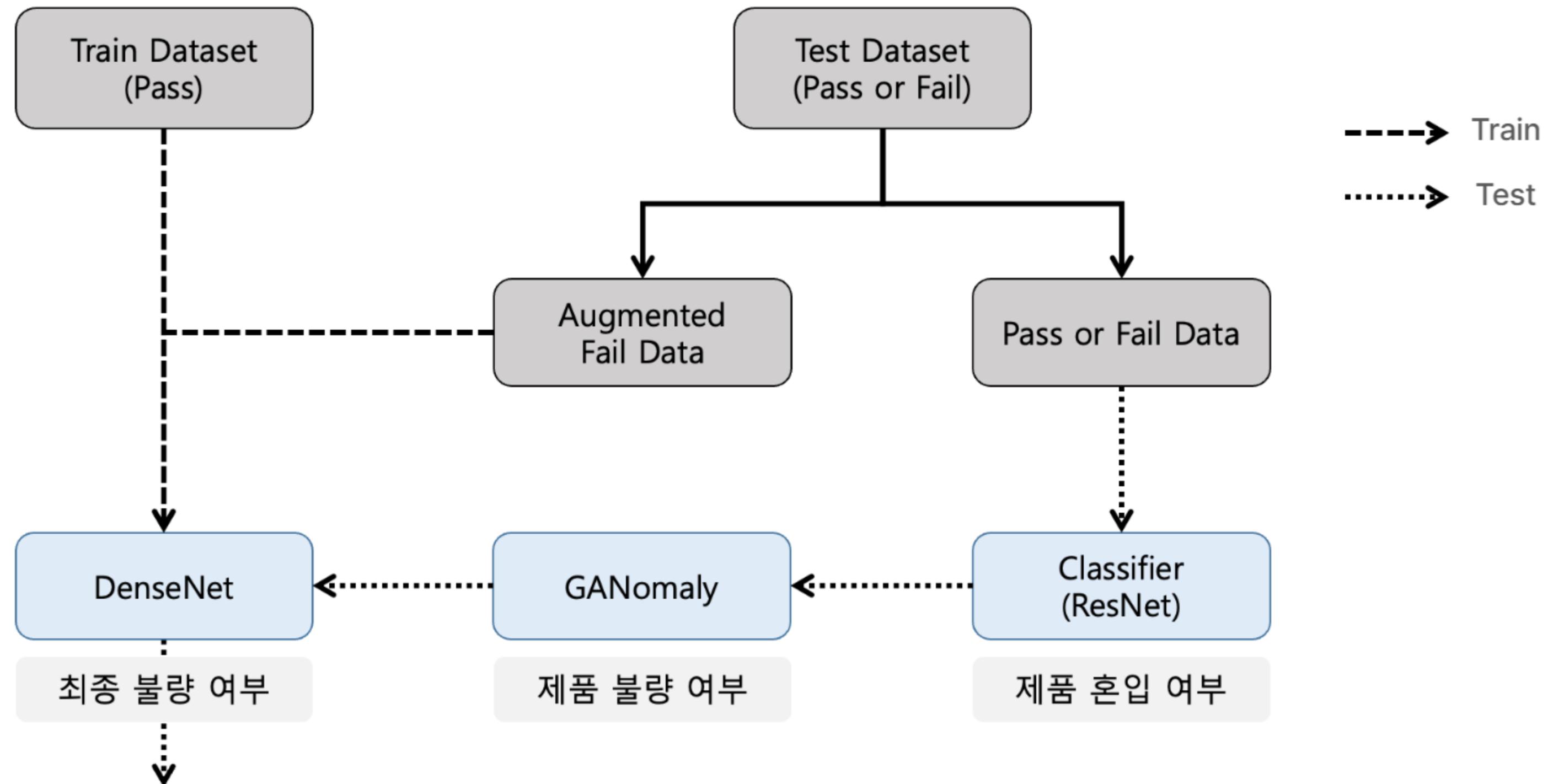
DenseNet

- 전체 기종 적용 결과

Model	Fail to Fail	Fail to Pass	Accuracy
FM2-V160	54	6	0.90
FM2-V161	17	8	0.68
FM2-V162	71	19	0.79
FM2-V163	2	0	1.00
FM2-V164	0	0	0.00
FM2-V165	4	0	1.00
FM2-V166	38	6	0.86
FM2-V167	0	0	0.00



Overall Process



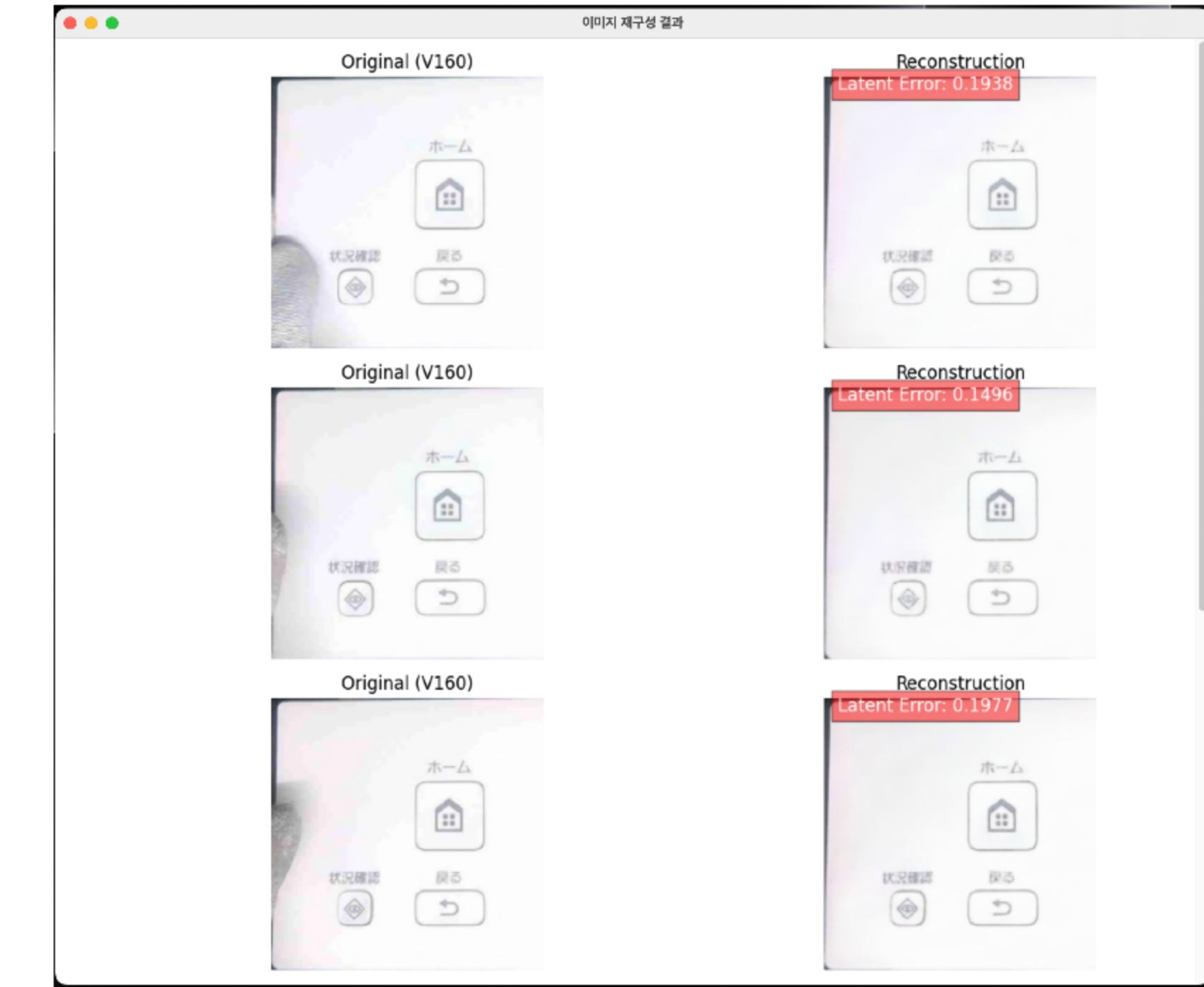
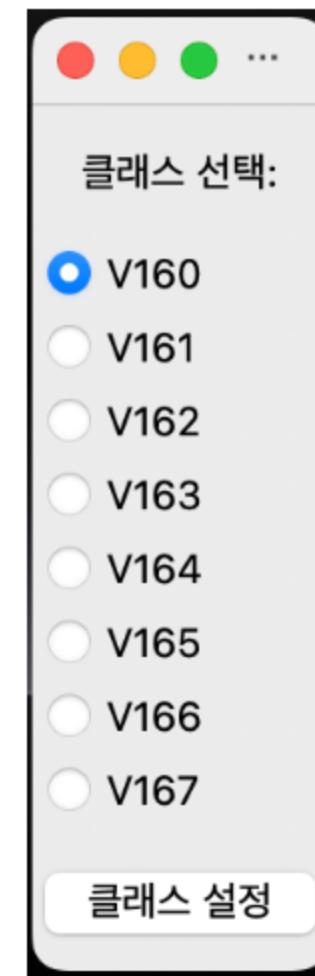
결론

- 01 기종 혼입 문제  ResNet50 모델을 통한 입력 이미지 클래스 분류 > 기종 혼입 탐지 가능
- 02 명확한 불량  이물질이 검사 영역을 명확하게 침범하는 경우 > GANomaly 모델을 통해 탐지 가능
- 03 그 외 불량  먼지 등 작은 이물질이 검사 영역에 포함된 경우 > DenseNet 모델을 통해 탐지 가능

결론

GUI

- PC 어플리케이션 형태로 구현



감사합니다



1조
Eigenvectors

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