



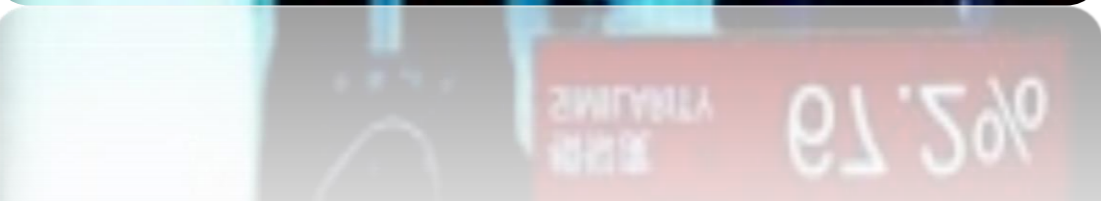
Deep-learned Object(Human, Vehicle) Identification using CCTVs

Geon Woo Kim
Information Security Research Division

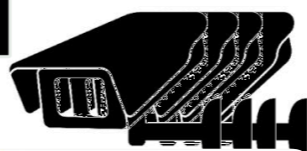
ETRI

Overview

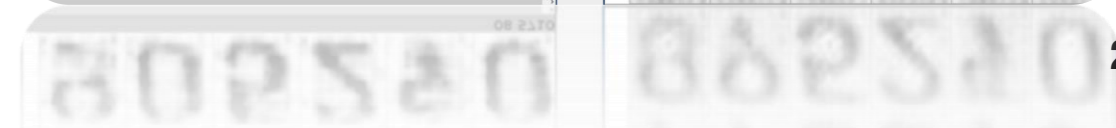
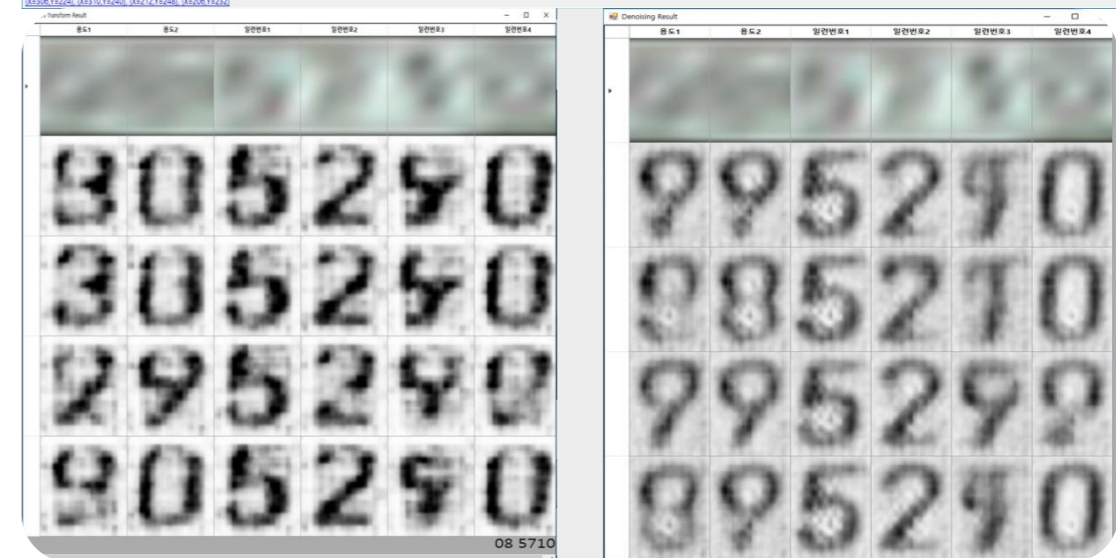
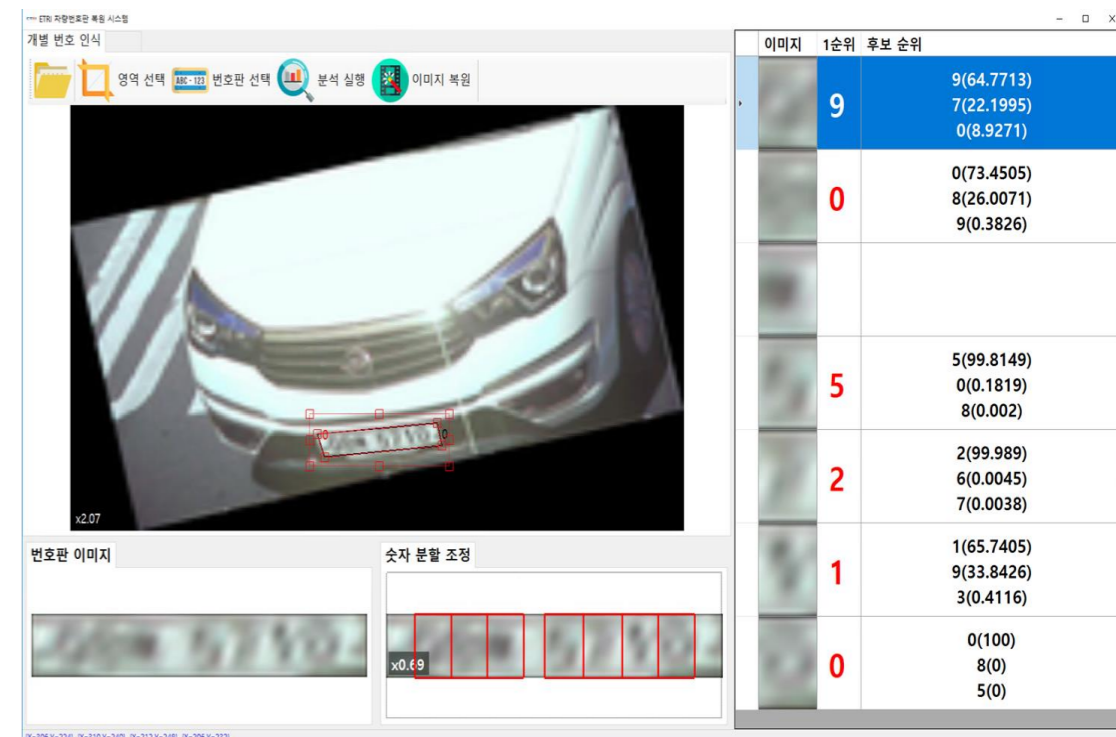
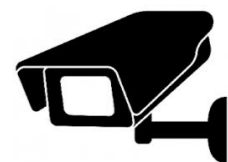
Face Recognition in the Wild



Human Re-id in the Wild



Number Plate Restoration



Face Recognition in the Wild

Performance

Database	Network	Network-1	Network-2
LFW		0.995±0.003	0.997±0.002
CFP_FP		0.925±0.013	0.932±0.012
AgeDB30		0.954±0.012	0.956±0.011

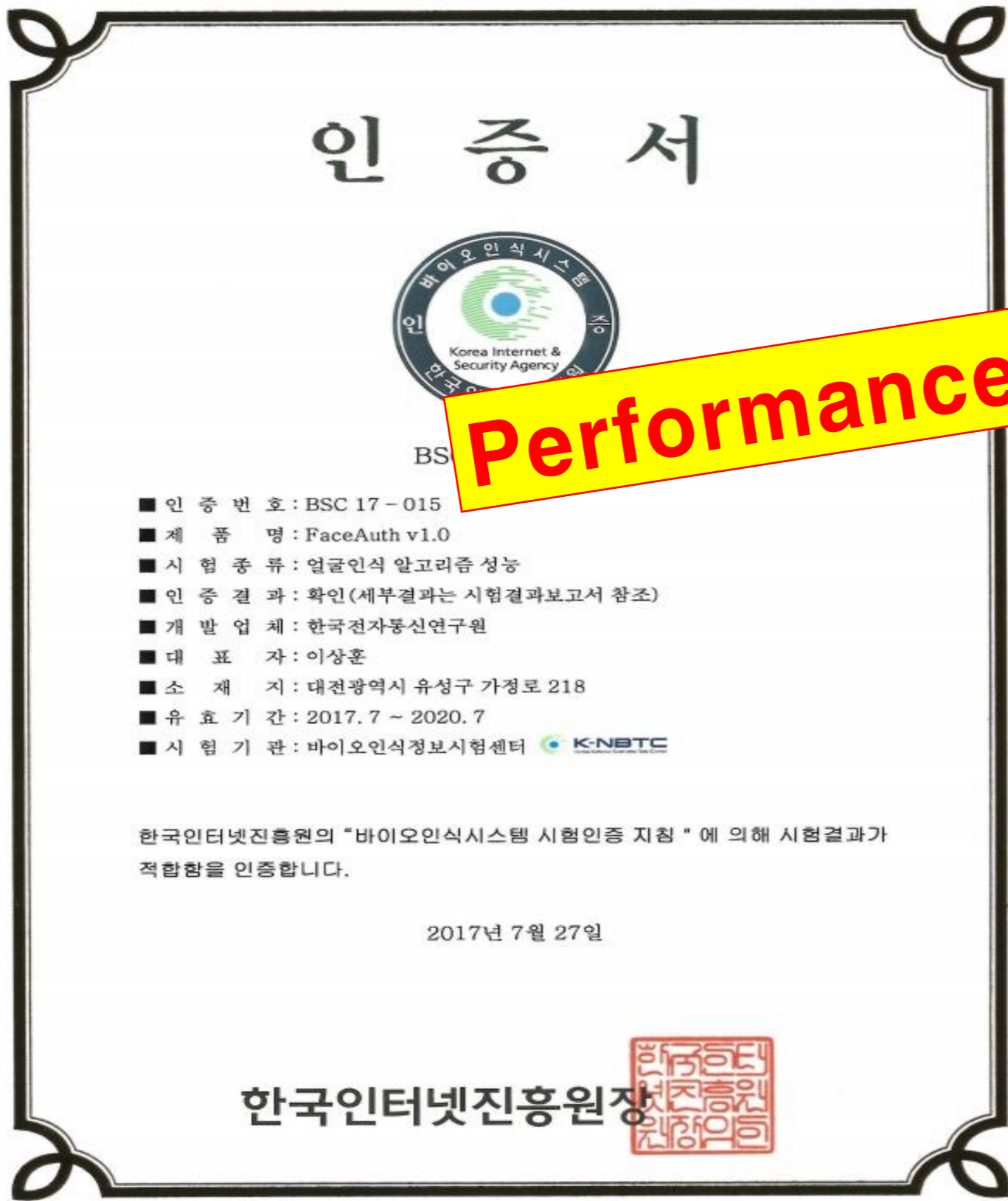
Dataset: Asian Face Dataset(97,979, 2,830,146)

Datasets

Database	# IDs	# images	# pairs
LFW	1,680	13,223	6,000
CFP_FP	500	7,000	7,000
AgeDB 30	570	12,240	6,000



Certificate(KISA)



Performance: 99.82%

□ 시험 조건

FRPT에서 사용된 얼굴 영상 데이터베이스의 구성은 <표 1>과 같다. <표 1>의 영상들을 이용하여 수행한 본인 대 본인, 본인 대 타인 정합 횟수는 <표 2>와 같다. 본시험 결과는 <표 3>과 같다.

<표 1> 시험용 얼굴 영상 데이터베이스의 구성

Subset	1 SET 500명		2 SET 500명	
	분류	영상수	분류	영상수
1	조명방향(8)	4,000	조명방향(8)	4,000
2	표정변화(4)	2,000	표정변화(4)	2,000
3	포즈(3)	1,500	포즈(3)	1,500
4	액세서리(2)	1,000	액세서리(2)	1,000

<표 2> 얼굴 정합 횟수

분류	정합 방식	본인 대 본인 (genuine)	본인 대 타인 (impostor)
		정합 횟수 (회)	조명
	표정	2,000	998,000
	포즈	1,500	748,500
	액세서리	1,000	499,000

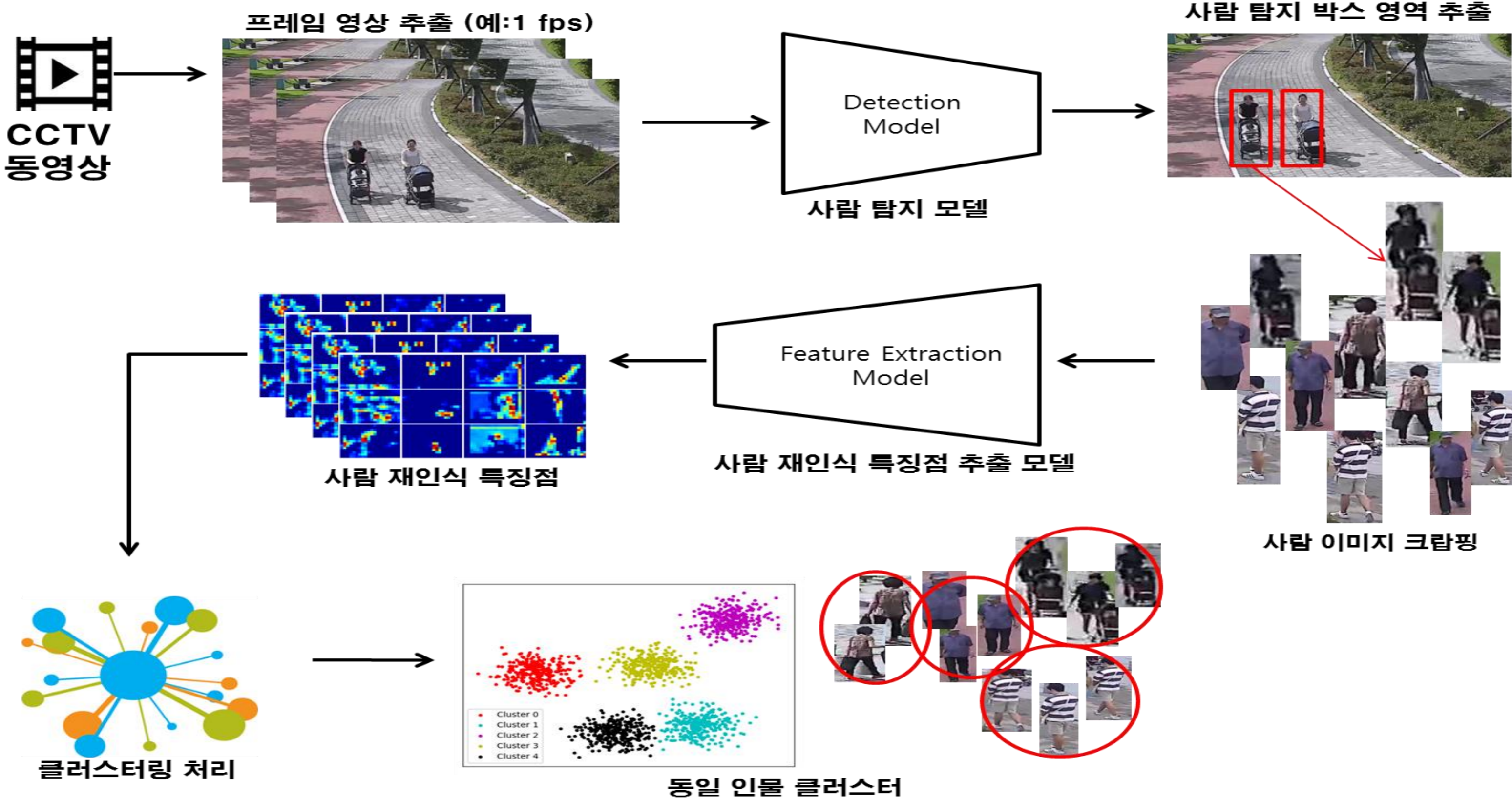
<표 3> K-NBTC의 본시험 결과 (Set-1, Set-2)

구분	조명	표정	포즈	액세서리
Set-1 EER(%)	0.20	0.20	0.15	0.37
Set-2 EER(%)	0.01	0.05	0.03	0.35
평균	0.11	0.12	0.09	0.41
Set-1 FTA(%)	0	0	0	0
Set-2 FTA(%)	0	0	0	0
평균	0	0	0	0
Set-1 FTE(%)	0	0	0	0
Set-2 FTE(%)	0	0	0	0
평균	0	0	0	0

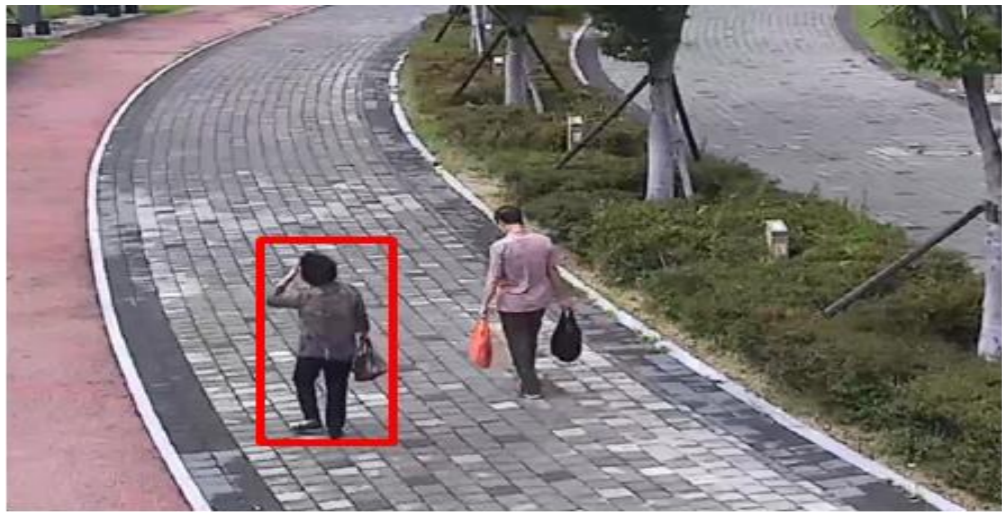
MCT: Human Re-Identification

- Human Detection
 - Technology of human detection in CCTV videos
 - Draw Bounding Box
- Human Re-identification
 - Technology of identifying same persons among multiple CCTVs
 - Rank 1, 3, 5, 10...
- Clustering
 - Technology of grouping same persons among multiple CCTVs
 - Classification into k clusters
- GUI, Client & Server Interface, Metadata
 - Graphical User Interface
 - Protocol between GUI and Server
 - Metadata for storing/loading result

Phase1 – Clustering same persons



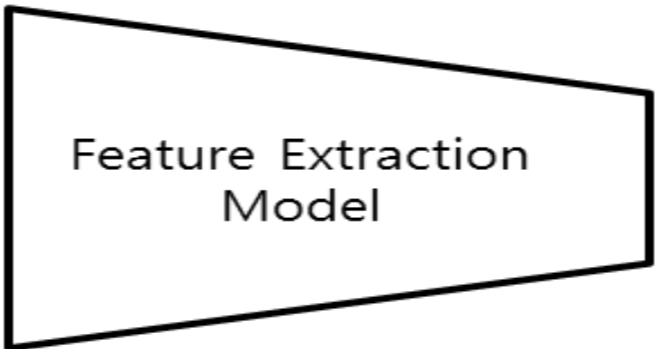
Phase2 – Searching target person



검색 대상 선정

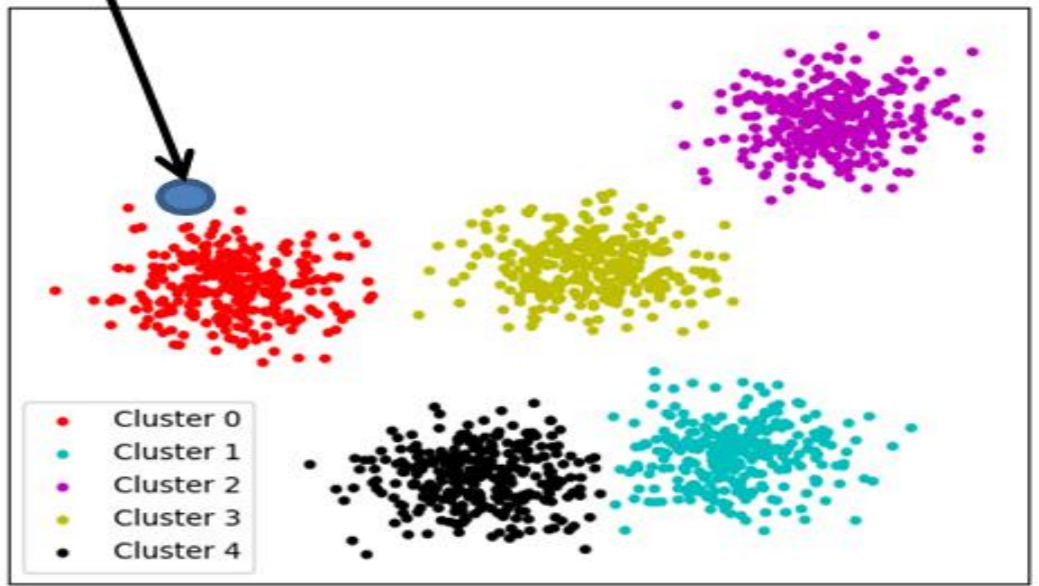


대상 이미지 크롭핑



사람 재인식 특징점 추출 모델

검색 이미지 특징점



Rank 1 Rank 2 Rank 3 Rank 4

클러스터 대표 이미지의 특징점과 검색대상 이미지의 특징점의 거리 비교를 통한 Ranking

Dataset

- Human Detection
 - 2,640 video clips of real CCTVs
 - GT: above 30,000
- Human Re-identification
 - DB for human re-identification from real CCTVs
 - GT: above 10,000

Performance

- Human Detection
 - Accuracy: when predicted object box includes pre-defined % (IoU) of GT box
 - In case of real CCTV videos
 - . Average Precision: 0.74 where IoU = 0.4
- Human Re-identification
 - Accuracy: ratio that first-ranked gallery ID is probe ID
 - Performance with openDB: 87.56%
 - . Acc@CUHK01: 85.60%
 - . Acc@CUHK03: 86.67%
 - . Acc@Market1501: 90.40%
 - Performance with real CCTV videos
 - . Test DB(BPCCTV): 38 persons, 1,155, 256*128 pixels
 - . Result: 81.60%

Performances

Dataset	Release time	# identities	# cameras	# images	Label method	Crop size	Multi-shot
CUHK01	2012	971	2	3884	Hand	160X60	✓
CUHK03	2014	1467	10(5 pairs)	13164	Hand/DPM	Vary	✓
Market1501	2015	1501	6	32217	Hand/DPM	128X64	✓
DukeMTMC-reID	2017	1812	8	36441	Hand	Vary	✓

OpenDB 기준 최고 성능

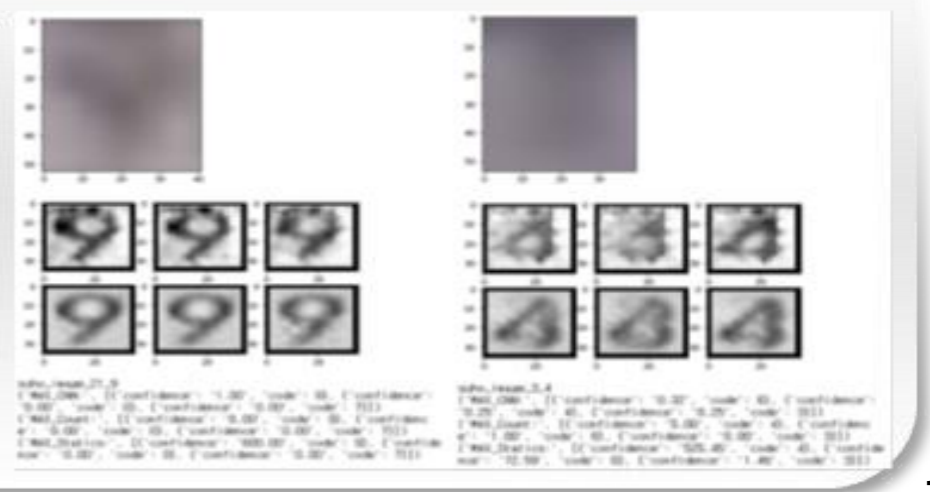
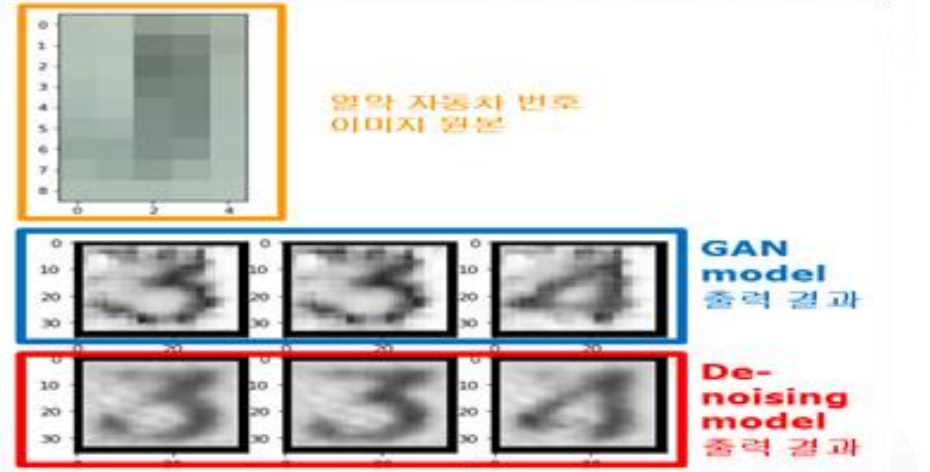
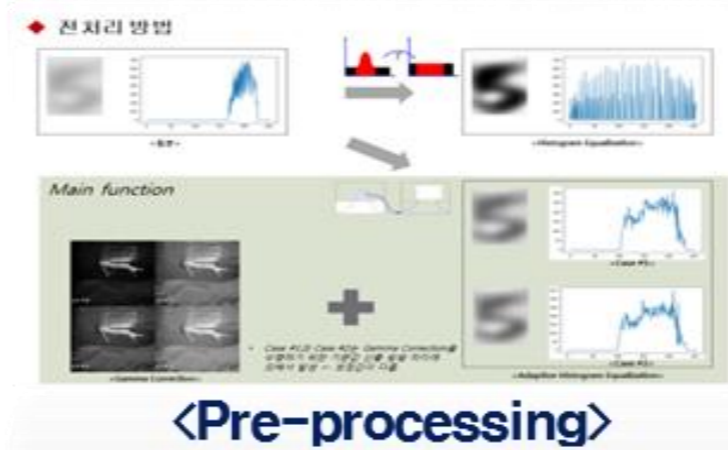
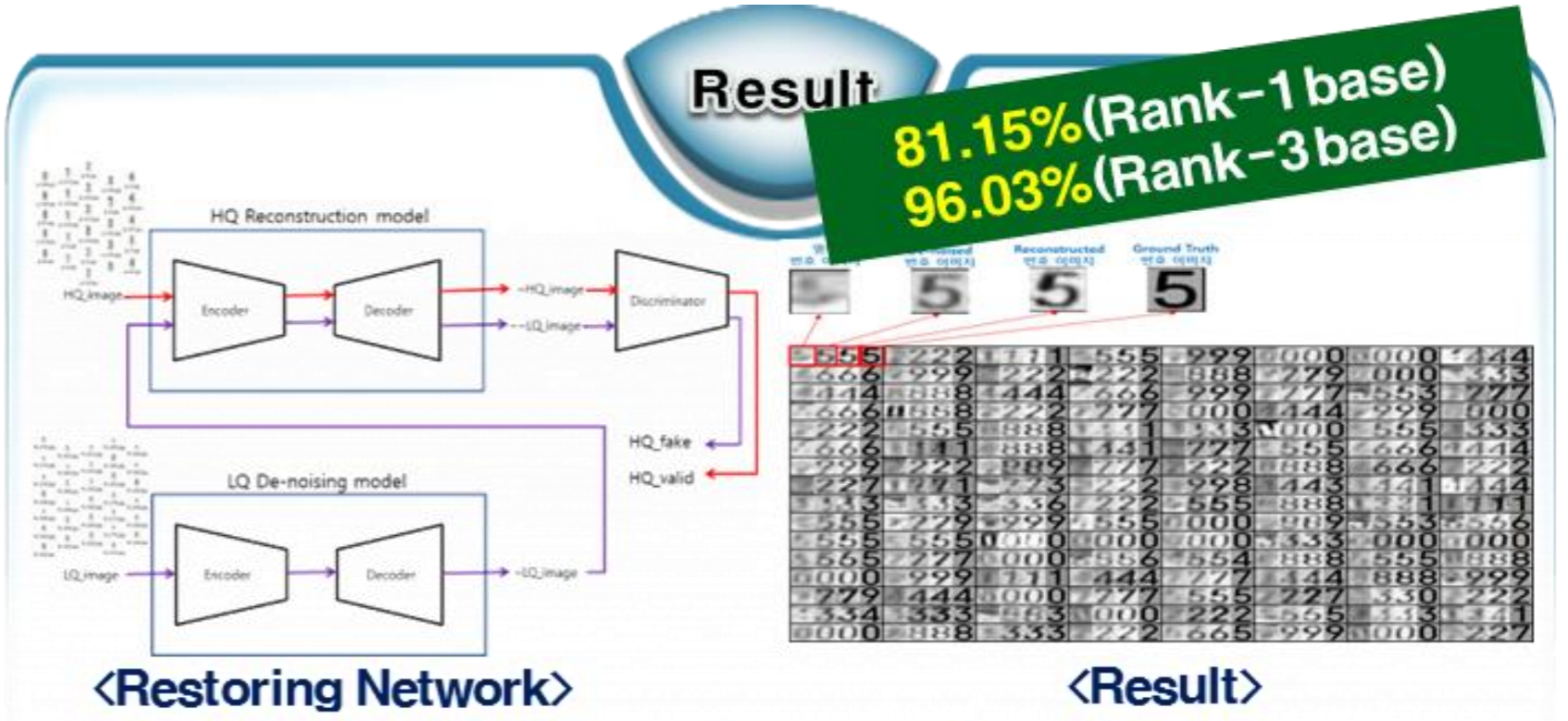
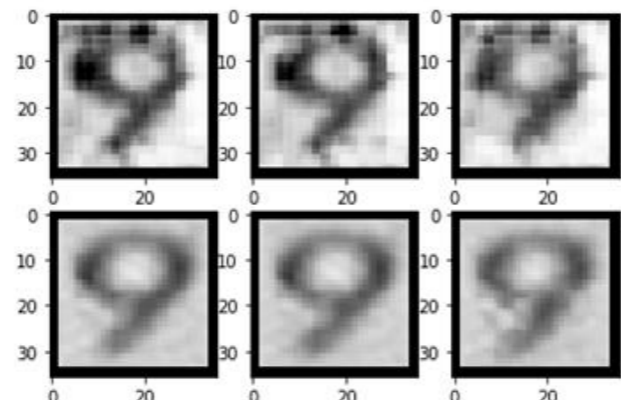
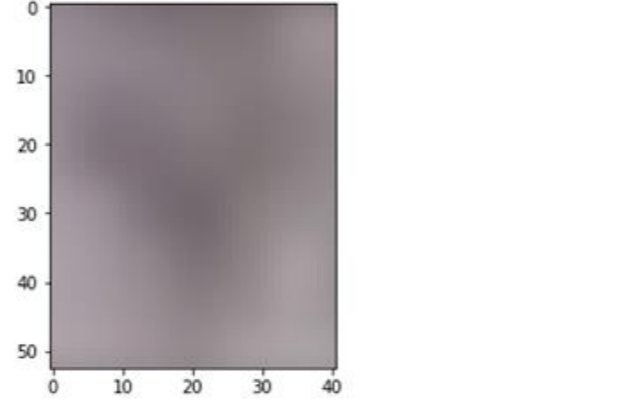
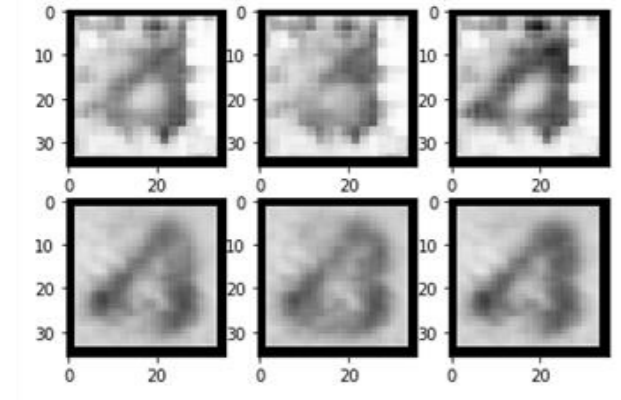
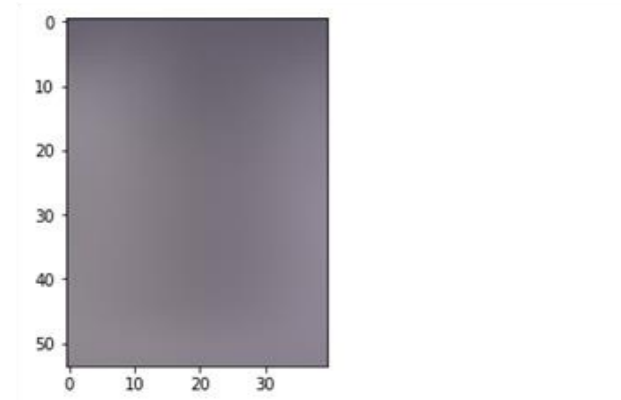
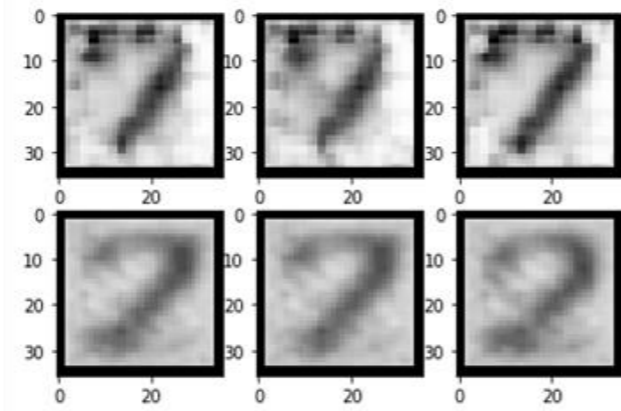
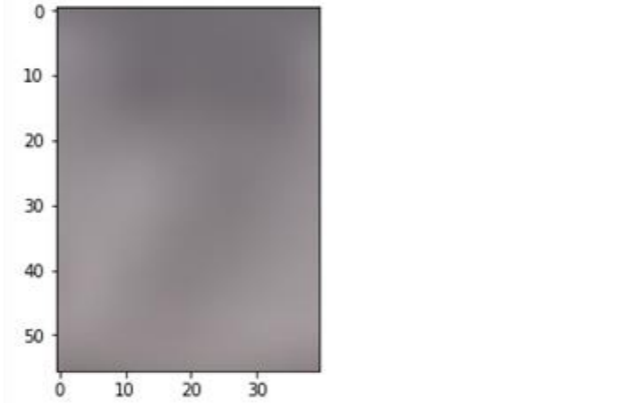
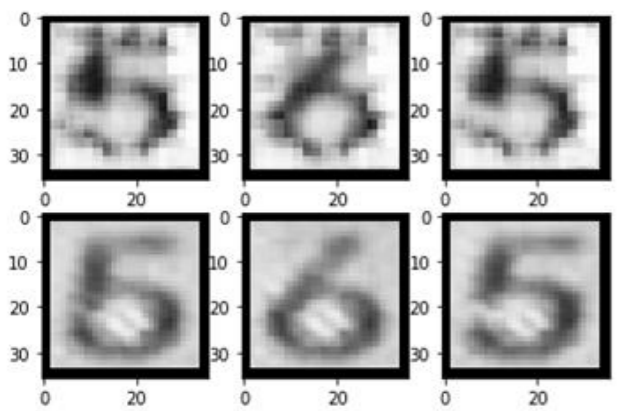
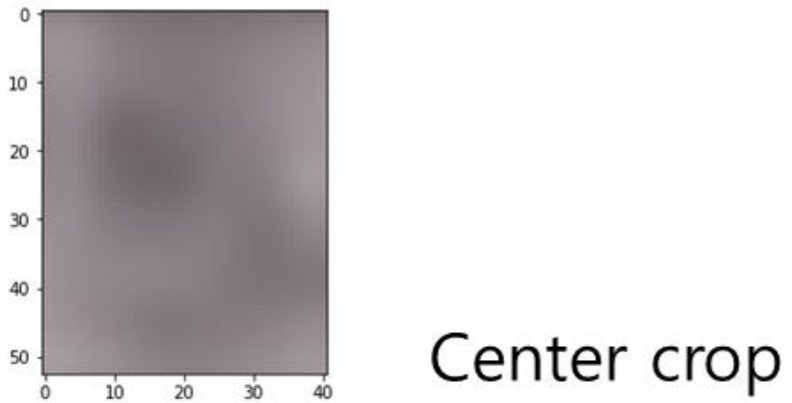
("Harmonious Attention Network for Person Re-Identification", Wei Li, Xiatian Zhu, Shaogang Gong, CVPR 2018)

- DukeMTMC-reID 80.5% @ rank 1 (mAP 63.8%)
- Market 1501 91.2% @ rank1 (mAP 80.5%)
- CUHK03 Labeled 44.4% @ rank1 (mAP 41.0%)
- CUHK03 Detected 41.7% @ rank 1(mAP 38.6%)

Demonstration

The screenshot displays a web-based monitoring interface. At the top, there are four navigation tabs: "Human ReID", "Vehicle ReID", "Event Management", and "Event Monitoring". The "Human ReID" tab is currently selected. On the left side, there is a sidebar with a dropdown menu showing "부산시민공원" (Busan Citizens' Park) and a small map of South Korea. Below this, there are three icons representing different project steps. A "Project Steps" section contains a button that says "검색 대상을 선택 하세요." (Select search target). Above the main map, there is a button with a camera icon and the text "파일에서 대상선택" (Select target from file). The main area is a large satellite map of South Korea, with a blue circular marker on the southern coast. In the bottom right corner of the map area, there is a copyright notice: "© Copyright by ETRI".

NPDR: Number Plate Deep Resolution



Demonstration

