Term Project Proposal

Real-time video-analytics system via camera stream

Professor:
Mongkol Ekpanyapong

Presented by:
st125457 - Ulugbek Shernazarov
st124473 - Thang Sian Hoih

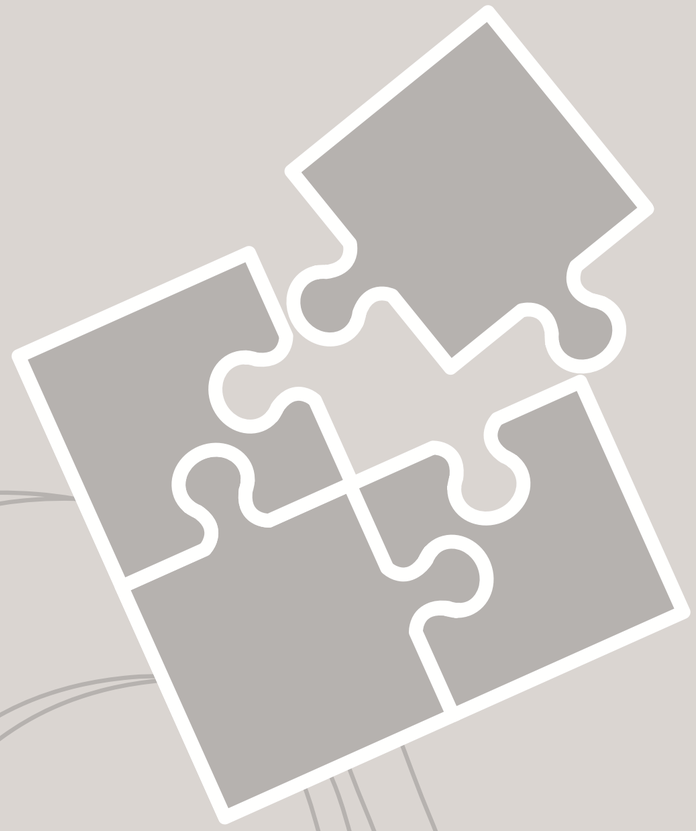
Overview

Introduction

Growing Need for Intelligent Video Analytics

- **Demand for enhanced security, efficient surveillance, and personalized services.**
- **Key applications: Surveillance, Access Control, Customer Engagement.**

Problems

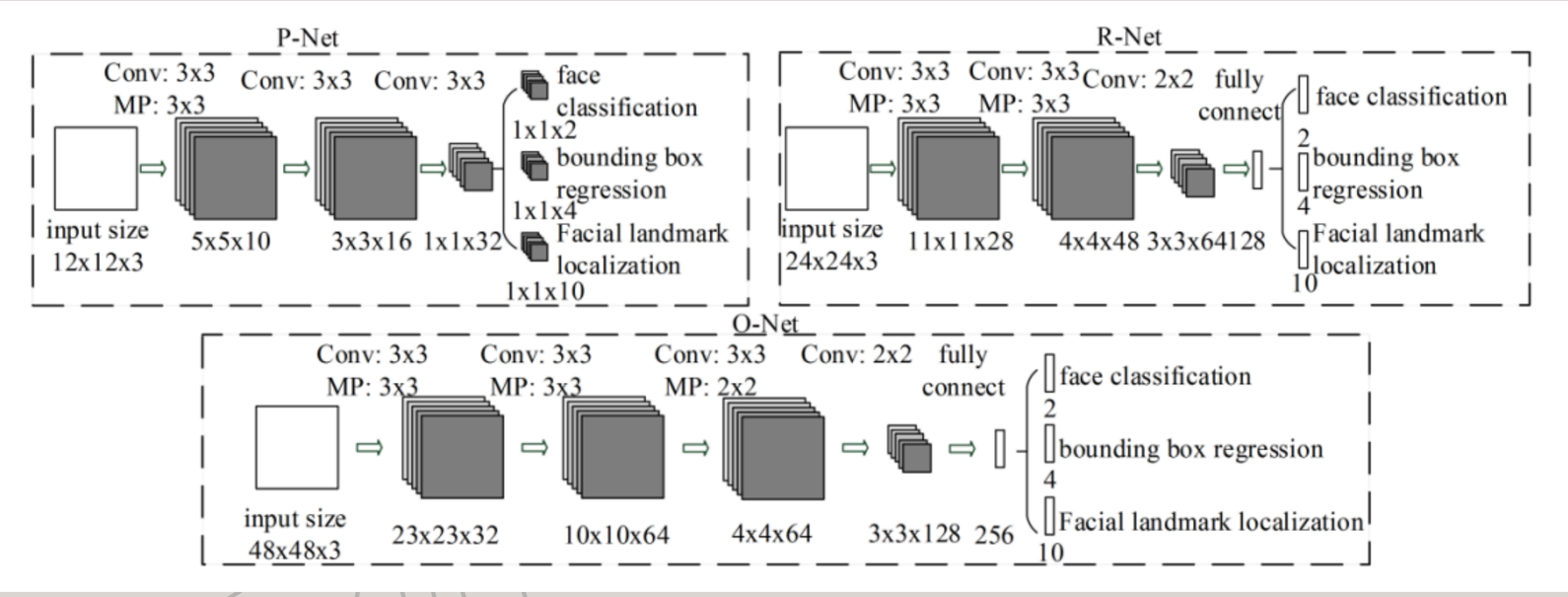


Challenges in Real-Time Video Analytics

- Handling dynamic environments with multiple faces.
- Variations in lighting, occlusions, and movement.
- Ensuring system scalability and real-time performance.

Methodology

Multi-task Cascaded Convolutional Neural Network



Face Detection:

- Early Methods: Viola-Jones (Haar features, cascaded classifier)
- Deep Learning: MTCNN (Joint detection & alignment)
- Datasets: FDDB, WIDER FACE, AFLW

Scrfd - Sample and Computation Redistribution for Efficient Face Detection

Methodology

Method	Venue	Train Data	LFW	CPLFW	AgeDB	CALFW	AVG	IJB-B	IJB-C
CosFace ($m = 0.35$) [?]	CVPR18	MS1MV2	99.81	92.28	98.11	95.76	96.82	94.80	94.56
ArcFace ($m = 0.50$) [?]	CVPR19	MS1MV2	99.83	93.08	98.02	96.30	96.81	94.58	94.03
AFRN [?]	ICCV19	MS1MV2	99.85	93.48	98.35	96.30	96.99	94.85	94.60
MV-Softmax [?]	AAAI20	MS1MV2	99.85	93.83	98.37	96.10	97.04	94.89	94.68
CurricularFace [?]	CVPR20	MS1MV2	99.80	93.24	98.32	96.20	97.16	94.80	94.51
URL [?]	CVPR20	MS1MV2	99.85	93.17	98.38	96.20	97.25	94.97	96.38
BroadFace [?]	ECCV20	MS1MV2	99.85	93.13	98.38	96.20	97.24	94.97	96.38
MagFace [?]	CVPR21	MS1MV2	99.83	93.32	98.23	96.03	97.10	94.74	94.96
SCF-ArcFace [?]	CVPR21	MS1MV2	99.80	93.16	98.18	96.03	97.10	94.75	94.95
DAM-CurricularFace [?]	ICCV21	MS1MV2	99.80	93.53	98.05	96.08	97.19	95.67	96.89
AdaFace ($m = 0.4$)	**CVPR22**	**MS1MV2**	**99.82**	**93.53**	**98.05**	**96.08**	**97.19**	**95.67**	**96.89**
VPL-ArcFace [?]	CVPR21	MS1MV3	99.83	93.45	98.06	96.12	97.42	95.56	96.70
AdaFace ($m = 0.4$)	**CVPR22**	**MS1MV3**	**99.83**	**93.63**	**98.17**	**96.10**	**97.43**	**95.84**	**97.09**
ArcFace* [?]	CVPR19	WebFace4M	99.83	93.45	98.06	96.12	97.46	95.75	97.16
AdaFace ($m = 0.4$)	**CVPR22**	**WebFace4M**	**99.80**	**94.63**	**97.90**	**96.05**	**97.51**	**96.03**	**97.39**

Adaptive Facial Embedding

Face Recognition:

- Traditional: Eigenfaces, Fisherfaces (Linear techniques)
- Deep Learning: FaceNet, ArcFace, AdaFace (High-dimensional embeddings)
- Datasets: IJB-B, IJB-C

Methodology

Face Tracking:

- Traditional: Mean Shift, CAMShift (Basic tracking)
- Probabilistic Models: Kalman Filter (Temporal consistency)
- Modern: Deep learning-based trackers (Complex dynamics)

Methodology

What have we implemented?

- Combined Detection, Recognition, and Tracking
- Real-time focus: DeepFace, OpenFace
- Challenges: Scalability, Robustness, Dynamic Environments

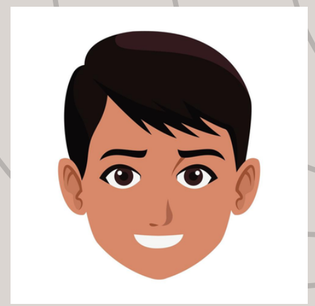
Pipeline

Face landmark + kpss

MTCNN Face detector

112x112x3

Face alignment



Adaface

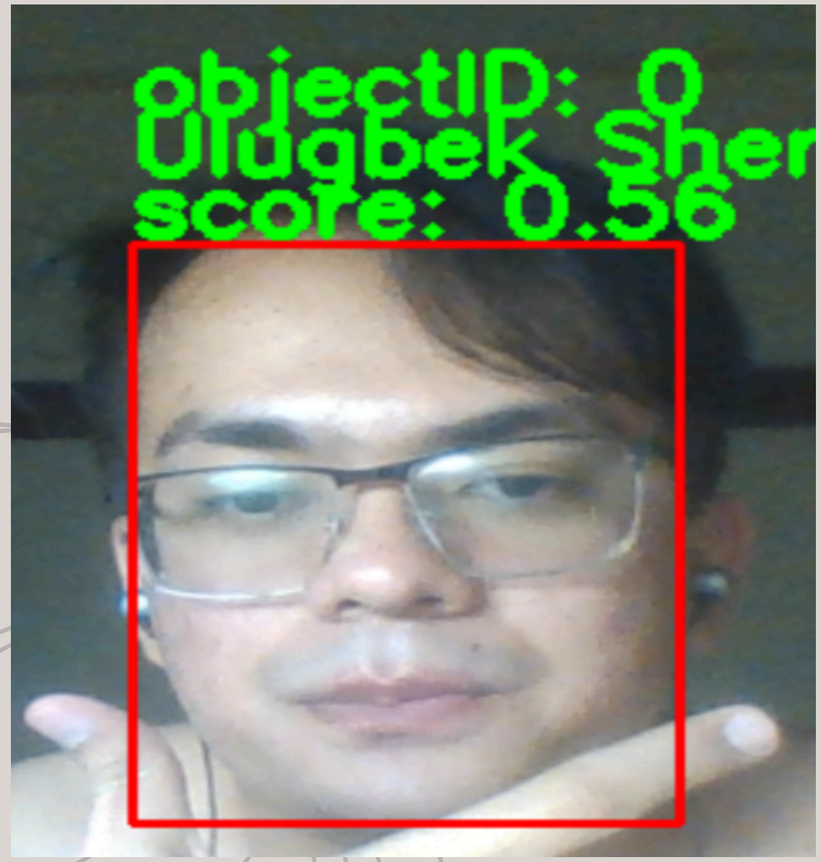
feature vector 512

Tracking

no feature extraction for faces already assigned id

We store feature vectors usually use noSQL dbs (chromadb, elasticsearch)

Demo



INFO => Recognized person: Ulugbek Shernazarov => 2024-12-01 21:25:53,400 9:25 PM

INFO => Recognized person: Ulugbek Shernazarov => 2024-12-01 21:26:13,752 9:26 PM

INFO => Recognized person: Ulugbek Shernazarov => 2024-12-01 21:26:51,113 9:26 PM

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Q INFO => Recognized person: Ulugbek Shernazarov => 2024-12-01 21:34:15,399 9:34 PM

Q INFO => Recognized person: Ulugbek Shernazarov => 2024-12-01 22:45:54,837 10:45 PM

Q INFO => Recognized person: Ulugbek Shernazarov => 2024-12-01 23:02:46,837 11:02 PM

Thank You

Presented for Deep Learning for Computer Vision