



DSFD: Dual Shot Face Detector

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Introduction

Motivation

- To detect faces with high degree of variability in scale, pose, occlusion, expression, appearance and illumination in real-world scenarios.

Contributions

- A novel Feature Enhance Module to utilize different level information and thus obtain more discriminability and robustness features.
- Auxiliary supervisions introduced in early layers via a set of smaller anchors to effectively facilitate the features.
- An improved anchor matching strategy to match anchors and ground truth faces as far as possible to provide better initialization for the regressor.
- Comprehensive experiments conducted on popular benchmarks Fddb and WIDERFACE to demonstrate DSFD is state-of-the-art method.

<https://github.com/TencentYouTuResearch/FaceDetection-DSFD>.

Method Analysis

Progressive Anchor Loss (PAL)

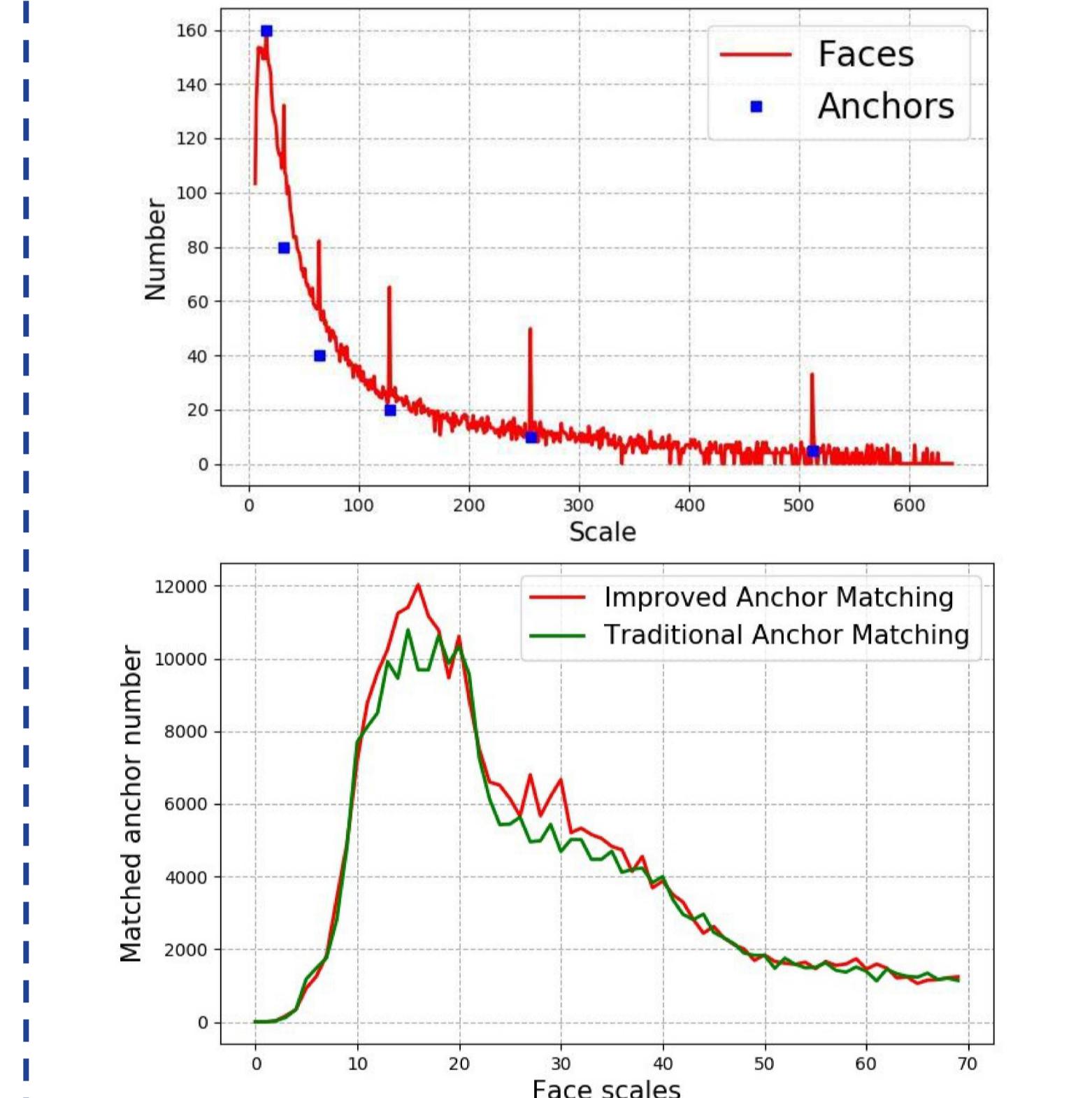
$$L_{SSL}(p_i, p_i^*, t_i, g_i, a_i) = \frac{1}{N_{conf}} \sum_i L_{conf}(p_i, p_i^*) + \frac{\beta}{N_{loc}} \sum_i p_i^* L_{loc}(t_i, g_i, a_i)$$

$$L_{FSL}(p_i, p_i^*, t_i, g_i, sa_i) = \frac{1}{N_{conf}} \sum_i L_{conf}(p_i, p_i^*) + \frac{\beta}{N_{loc}} \sum_i p_i^* L_{loc}(t_i, g_i, sa_i)$$

Feature	Stride	Size	Scale	Ratio	Number
ef_1(of_1)	4	160x160	16(8)	1.5:1	25600
ef_2(of_2)	8	80x80	32(16)	1.5:1	6400
ef_3(of_3)	16	40x40	64(32)	1.5:1	1600
ef_4(of_4)	32	20x20	128(64)	1.5:1	400
ef_5(of_5)	64	10x10	256(128)	1.5:1	100
ef_6(of_6)	128	5x5	512(256)	1.5:1	25

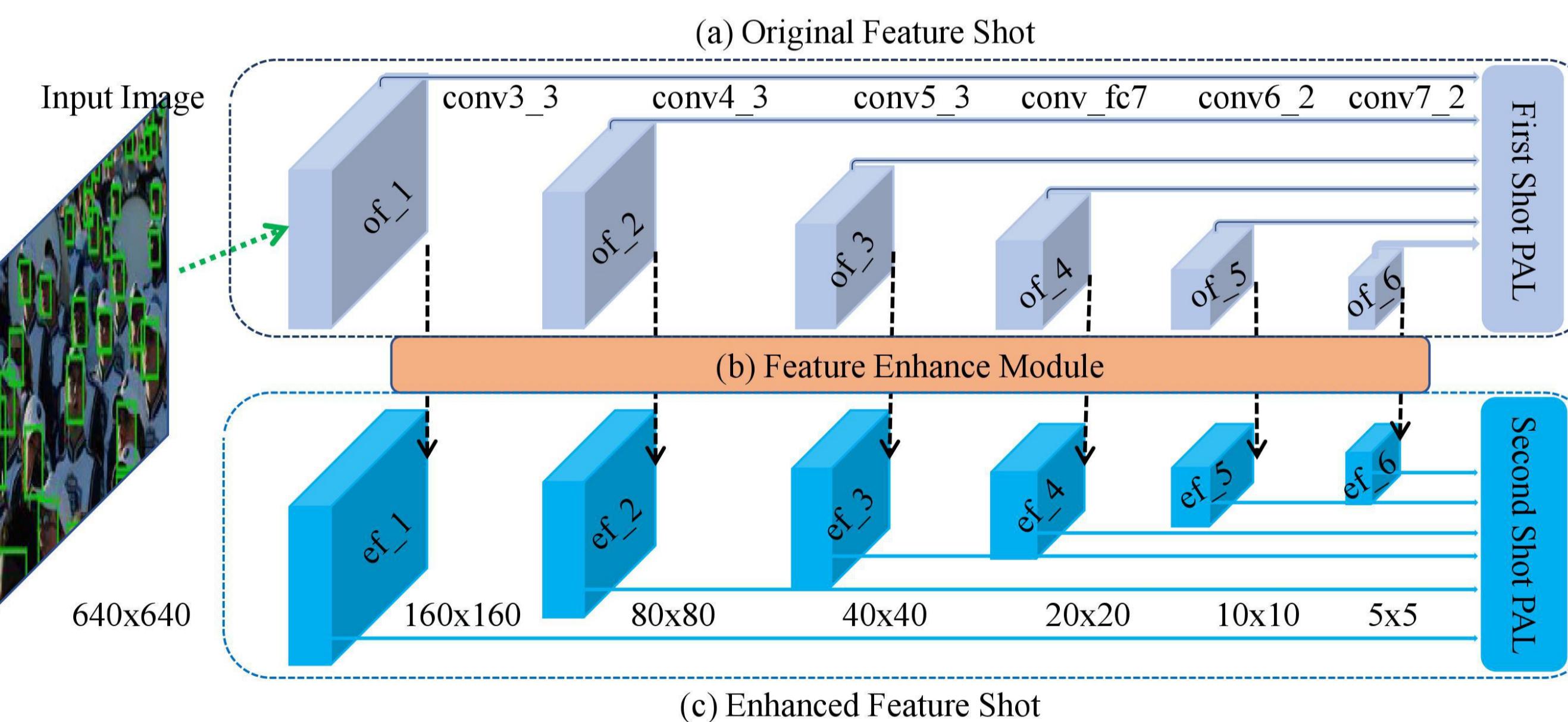
Improved Anchor Matching (IAM)

- To address the contradiction between the discrete anchor scales and continuous face scales. We use ssd data augmentation and anchor-based sampling. We also increase matching IoU to 0.4.

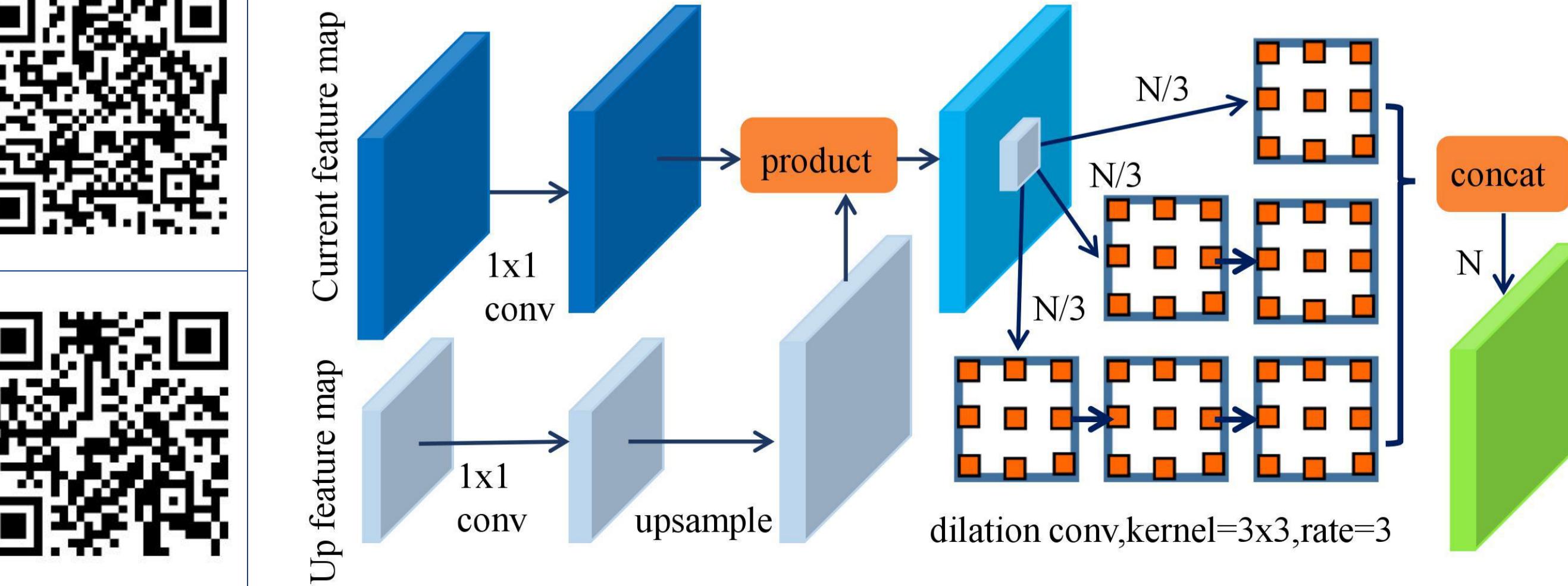


Network Architecture

Dual Shot Face Detector (DSFD)

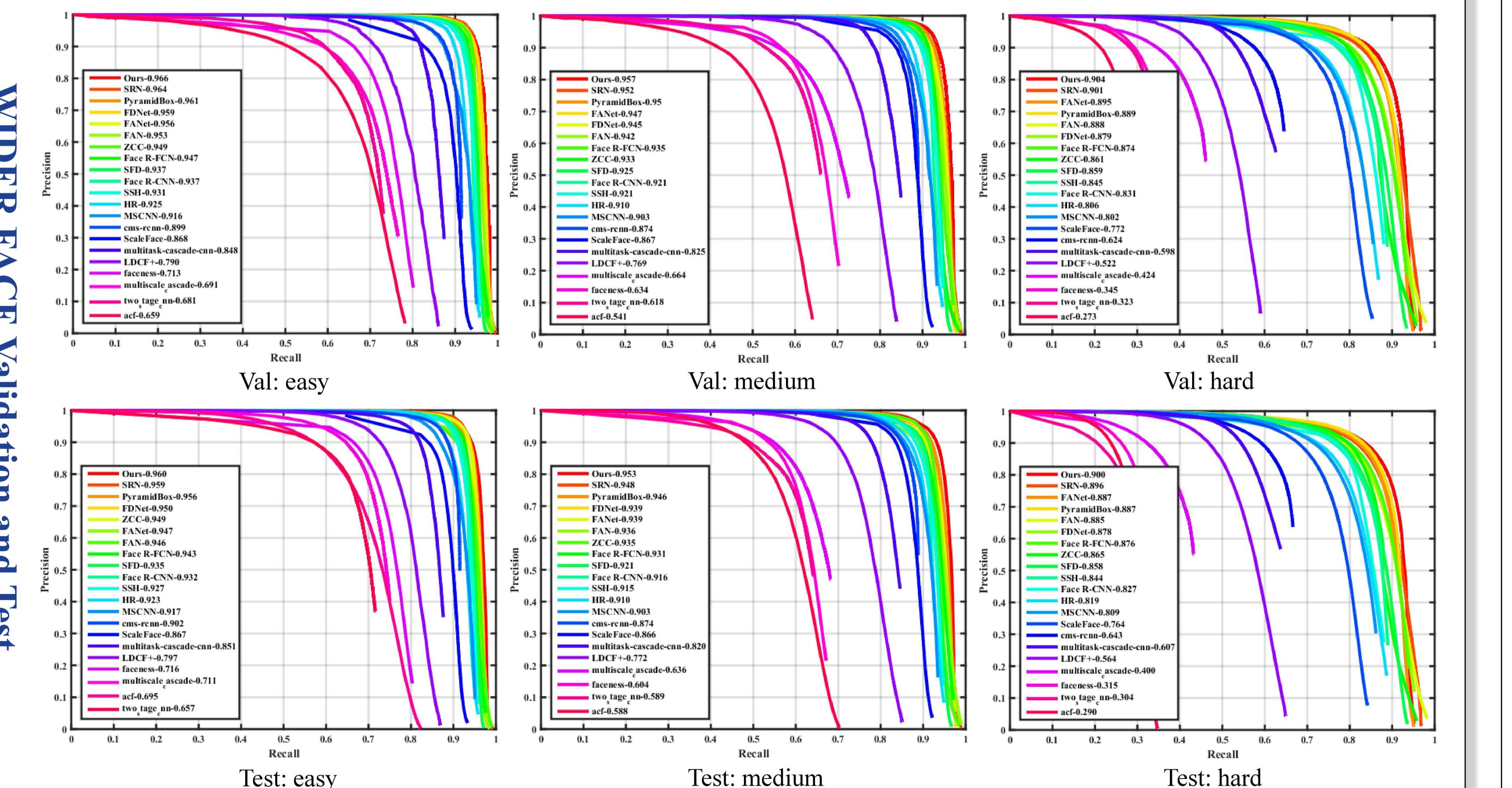


Feature Enhance Module (FEM)



Quantitative Results

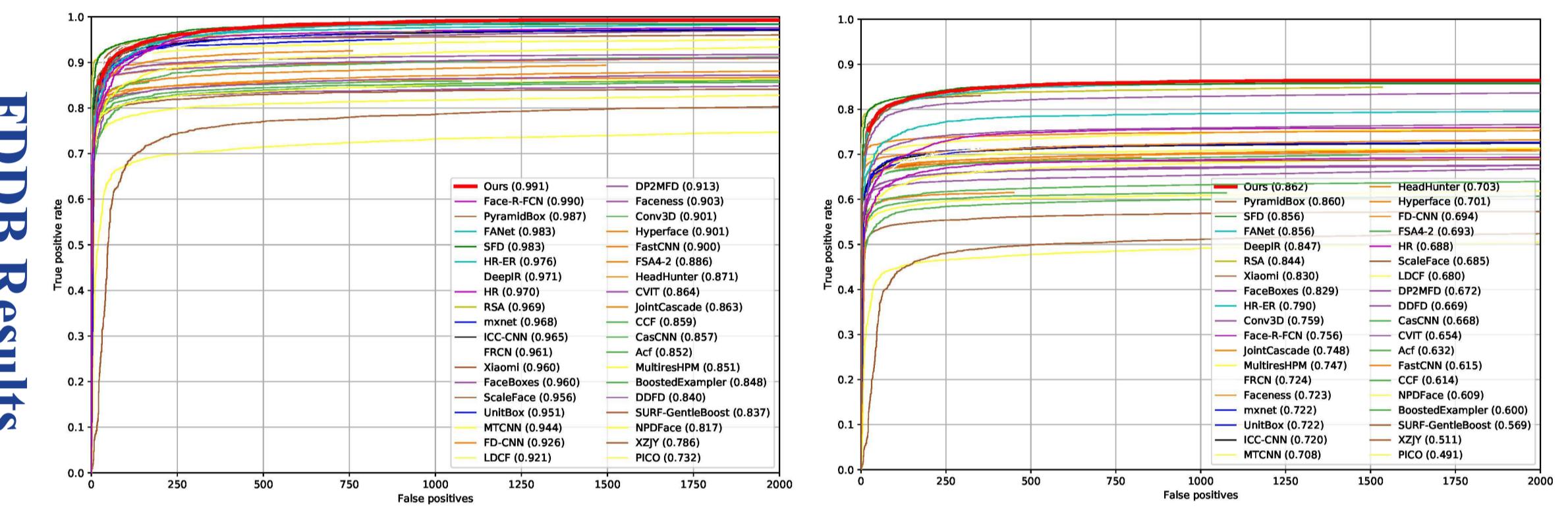
WIDER FACE Validation and Test



Ablation Study

Component	easy	medium	hard
FSSD+RES101	95.1%	93.6%	83.7%
FSSD+RES101+FEM	95.8%	95.1%	89.7%
FSSD+RES101+FEM+IAM	96.1%	95.2%	90.0%
FSSD+RES101+FEM+IAM+PAL	96.3%	95.4%	90.1%
FSSD+RES152+FEM+IAM+PAL	96.6%	95.7%	90.4%
FSSD+RES152+FEM+IAM+PAL+LargeBS	96.4%	95.7%	91.2%

FDDB Results



Visual Results

