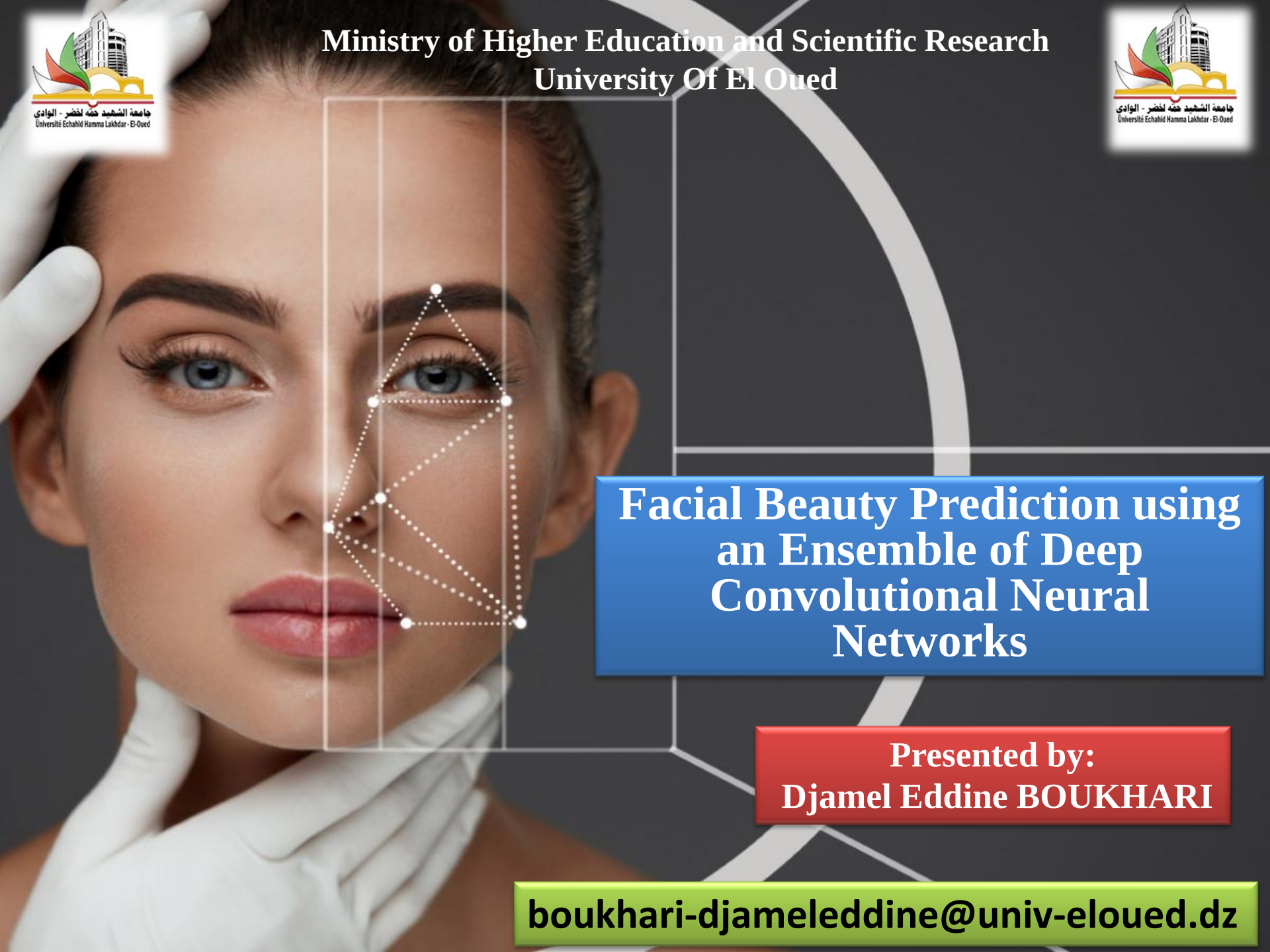
Ministry of Higher Education and Scientific Research
University Of El Oued

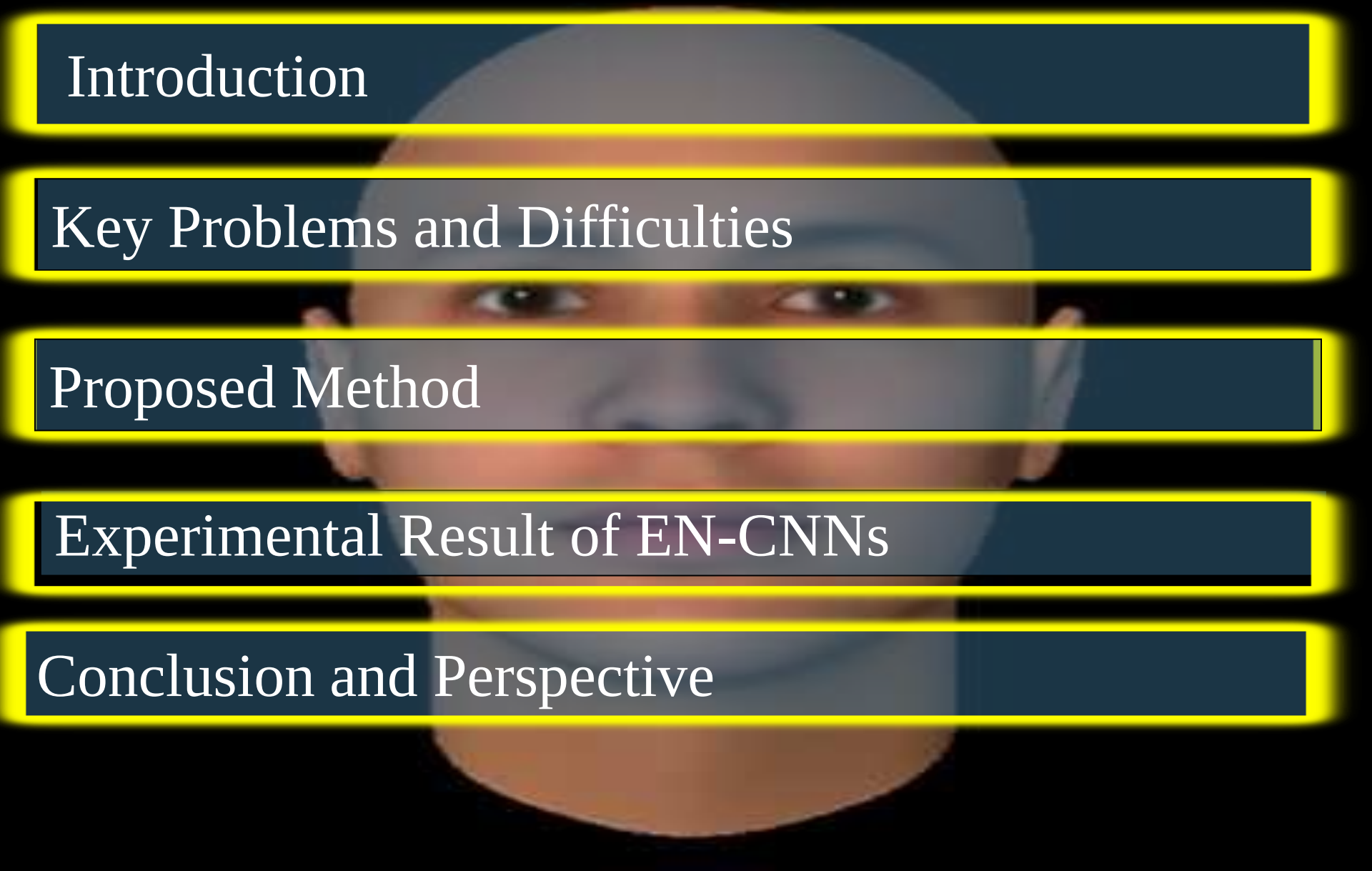


Facial Beauty Prediction using an Ensemble of Deep Convolutional Neural Networks

Presented by:
Djamel Eddine BOUKHARI

boukhari-djameleddine@univ-eloued.dz

CONTENTS

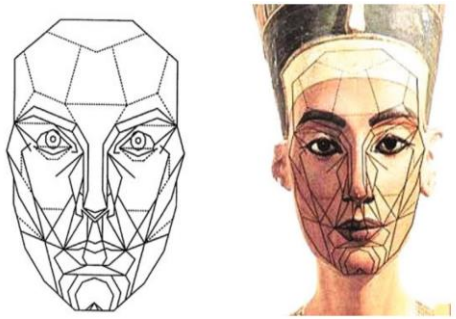


Introduction

- Facial beauty analysis is an emerging topic. The study of facial beauty has attracted efforts of researchers from diverse fields.
- Face Analysis to recognize facial attributes (such as gender, race, beauty, age, expression, etc.) from a portrait image. It has been widely used among SNS and short video platforms (like TikTok, Facebook and Instagram).

History of Facial Beauty Research

- The exploration of human physical beauty dates back 4000 years.



Left Marquardt's Phi mask Right Egyptian queen Neferneferuaten Nefertiti (1370–1330 BC)

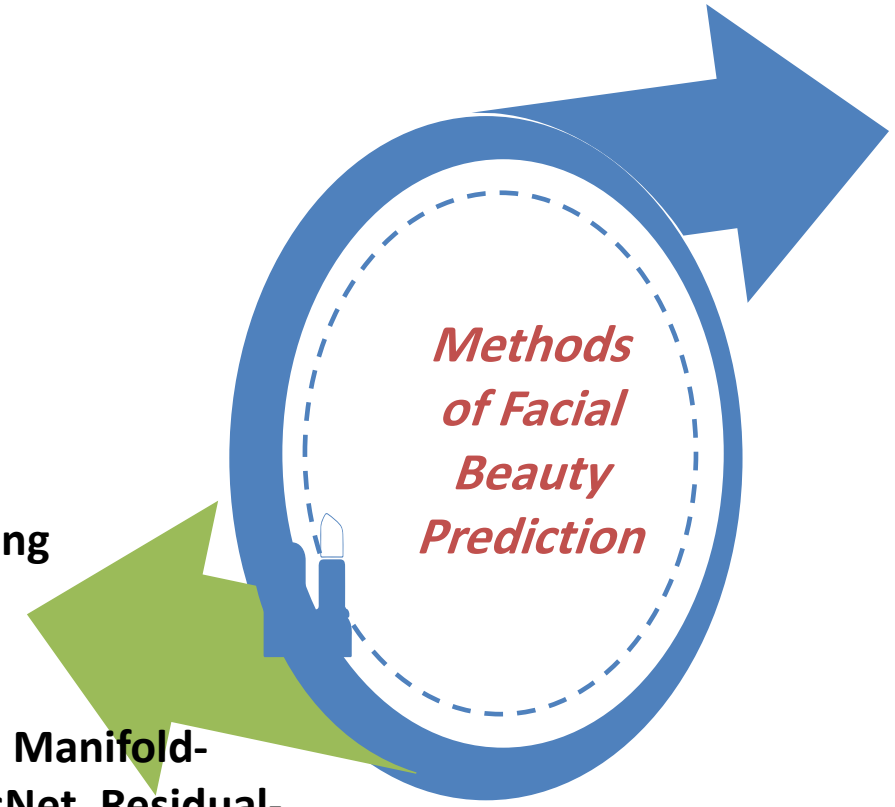
- In 1960s, two important findings facilitated the study of facial beauty in the psychological field.

Key Problems and Difficulties

- Deepen the understanding of facial beauty perception.
- More accurate facial beauty prediction.
- Face beautification. It is a typical application of the learned facial beauty rules and models.
- Develop application systems.

- Computer-based facial beauty analysis
- There is no public database for facial beauty study.
- The goal of facial beauty analysis is different from other facial analysis tasks.
- In facial beauty study, perception experiments have to be often carried out, which require a lot of labor and time consumption.

Facial Beauty Prediction Methods



02

Semi-supervised Learning

Manifold-learning
FSCLDE, NFME ..etc

01

Supervised Learning

A meta-learning, Manifold-learning, MT-ResNet, Residual-in-residual Nets, AaNet , R3CNN, CRNet, PI-CNN ..etc

Proposed Method

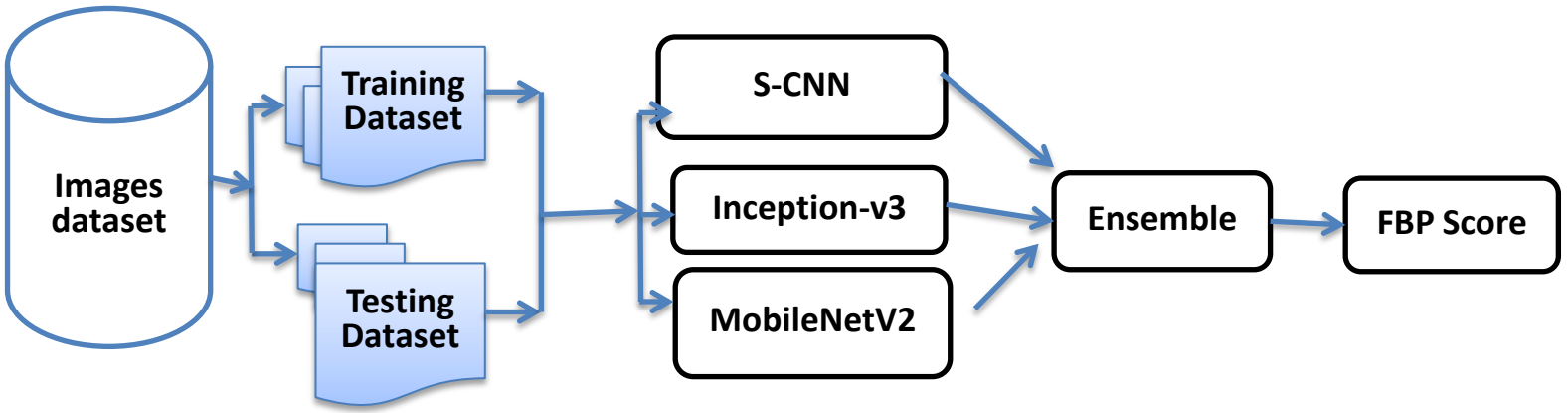


Figure: Proposed deep CNN ensemble networks (EN-CNNs)

S-CNNs Network Proposed

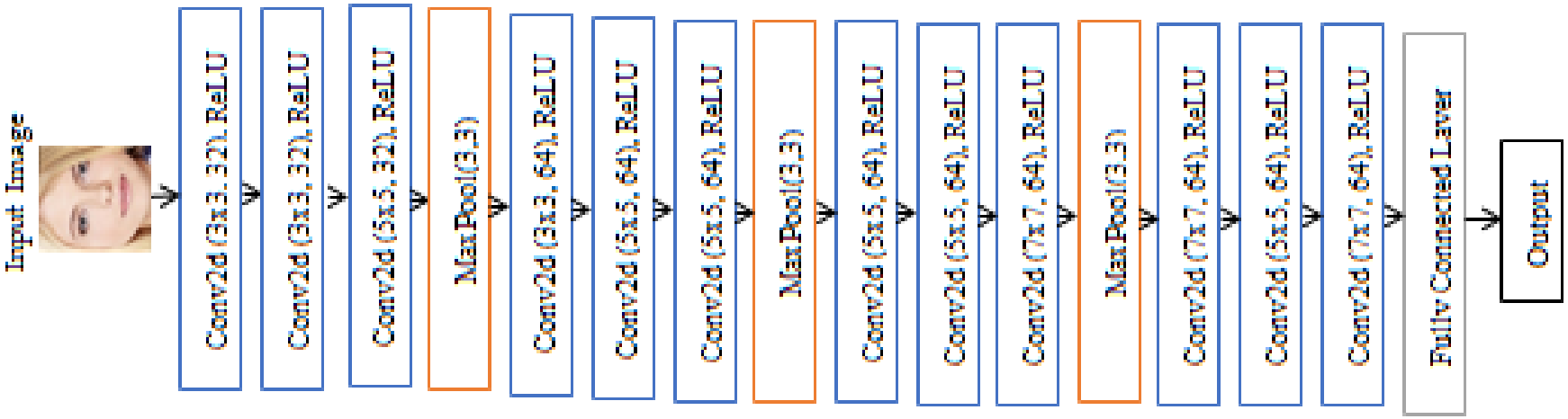
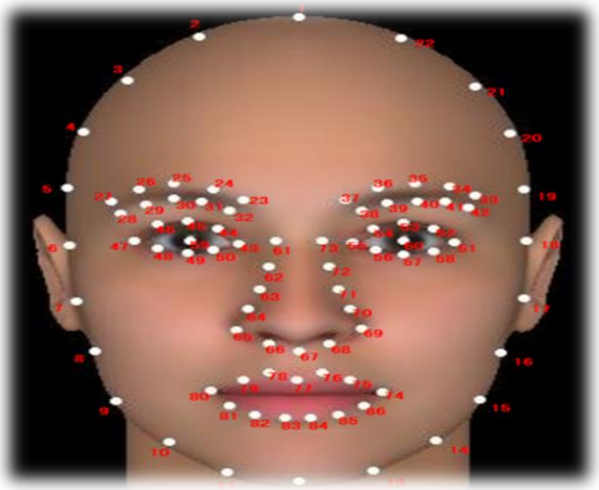


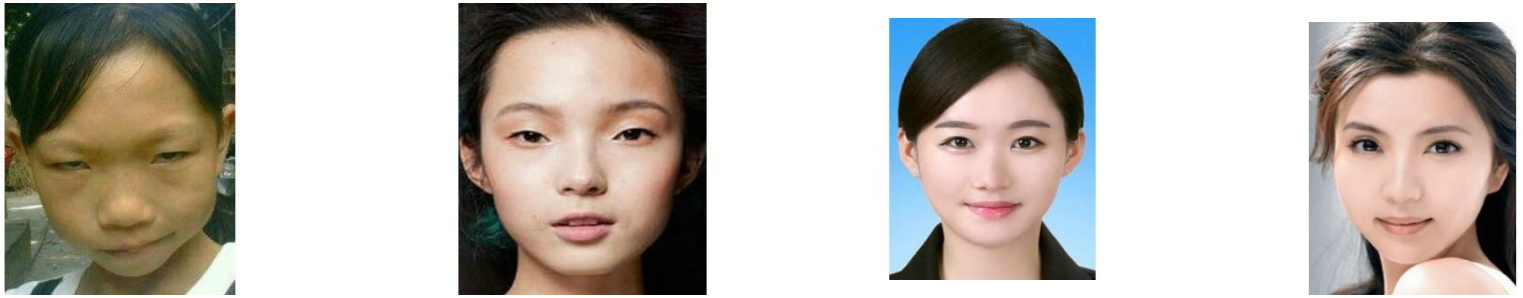
Figure. The architecture of proposed S-CNNs network

Experimental Result of EN-CNNs

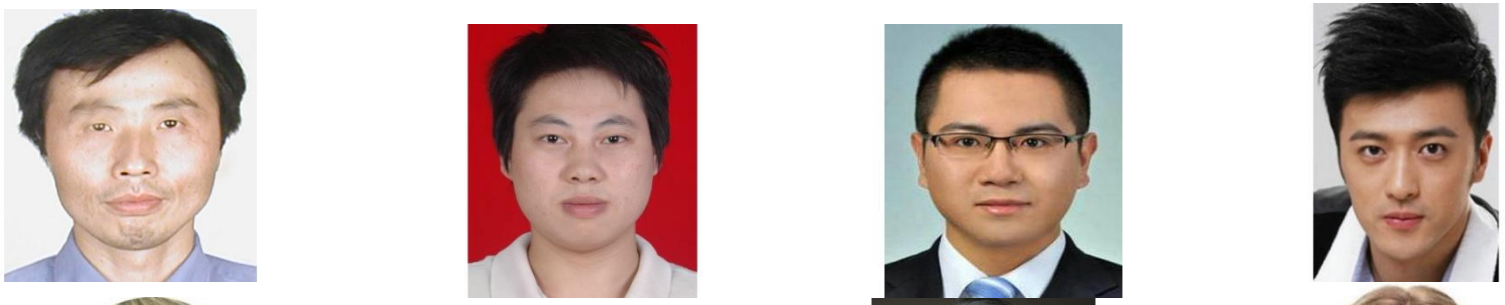


Facial beauty samples from the SCUT-FBP5500 database used

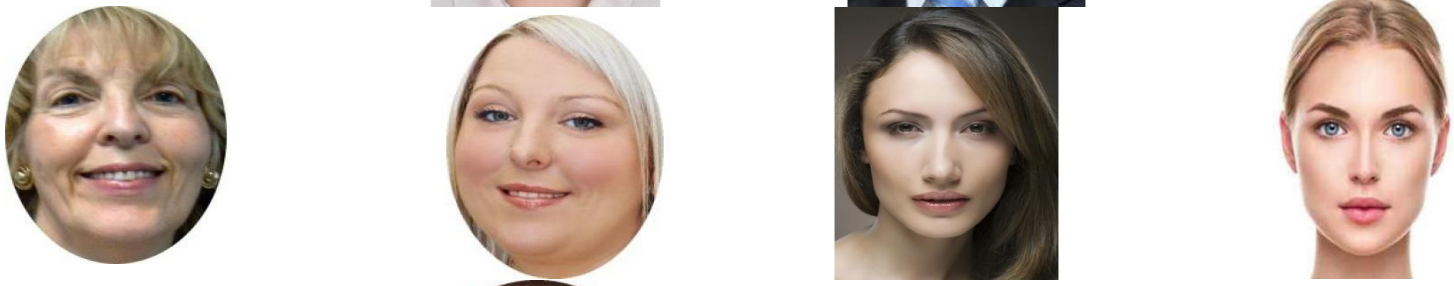
(a) Female Asian



(b) Male Asian



(c) Female Caucasian

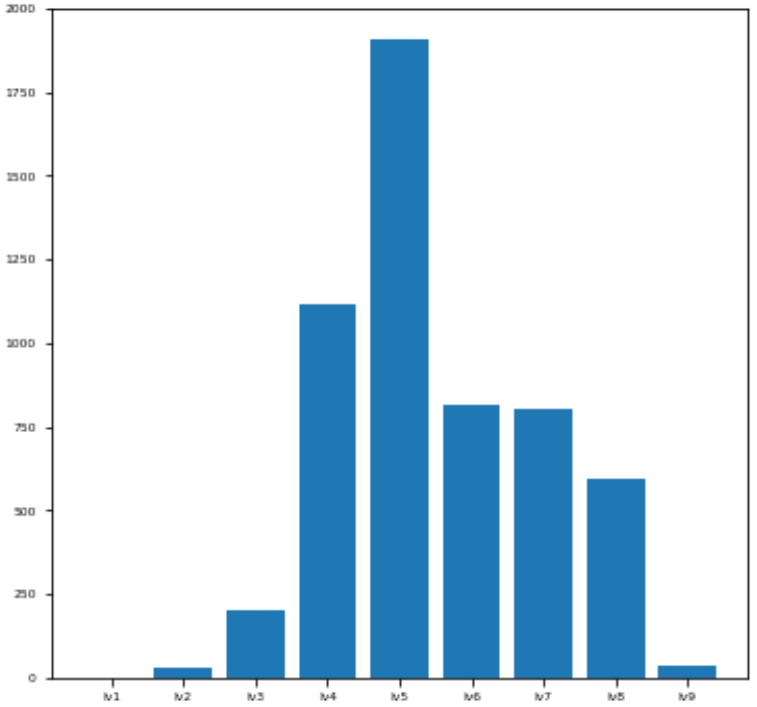


(d) Male Caucasian

Scores SCUT-FBP 5500

- Lv1 : x<1 : 0
- Lv2 : x>=1 and x<1.5 : 28 items
- Lv3 : x>=1.5 and x<2 : 203
- Lv4 : x>=2 and x<2.5 : 1115
- Lv5 : x>=2.5 and x<3 : 1907
- Lv6 : x>=3 and x<3.5 : 814
- Lv7 : x>=3.5 and x<4 : 801
- Lv7 : x>=4 and x<4.5 : 594
- Lv9 : x>=4.5 : 38

Total : FBP 5500



Performance Evaluation

- Mean Absolute Error (MAE)

$$MAE = \frac{1}{N}\sum_{i=1}^{N}|y_i - \hat{y}_i|$$

- Root Mean Squared Error (RMSE)

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}$$

- Pearson Correlation (PC)

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

Result of Proposed Method

Table 1. Performance comparisons on the SCUT-FBP5500 dataset

Methods	Pre-training	MAE ↓	RMSE ↓	PC ↑
AlexNet [15]	ImageNet	0.2651	0.3481	0.8634
ResNet-18 [15]	ImageNet	0.2419	0.3166	0.8900
ResNeXt-50 [15]	ImageNet	0.2291	0.3017	0.8997
CNN – SCA [5]	ImageNet	0.2287	0.3014	0.9003
R3CNN [16]	ImageNet	0.2120	0.2800	0.9142
Semi-supervised[20]	VGGFace2	0.2210	0.2870	0.9113
CNN-ER [22]	VGGFace2	0.2009	0.2650	0.9250
NAS4FBP Net [23]	ImageNet	0.1939	0.2579	0.9275
EN-CNN Ours	**ImageNet**	**0.1933**	**0.2482**	**0.9350**

Result of Proposed Method

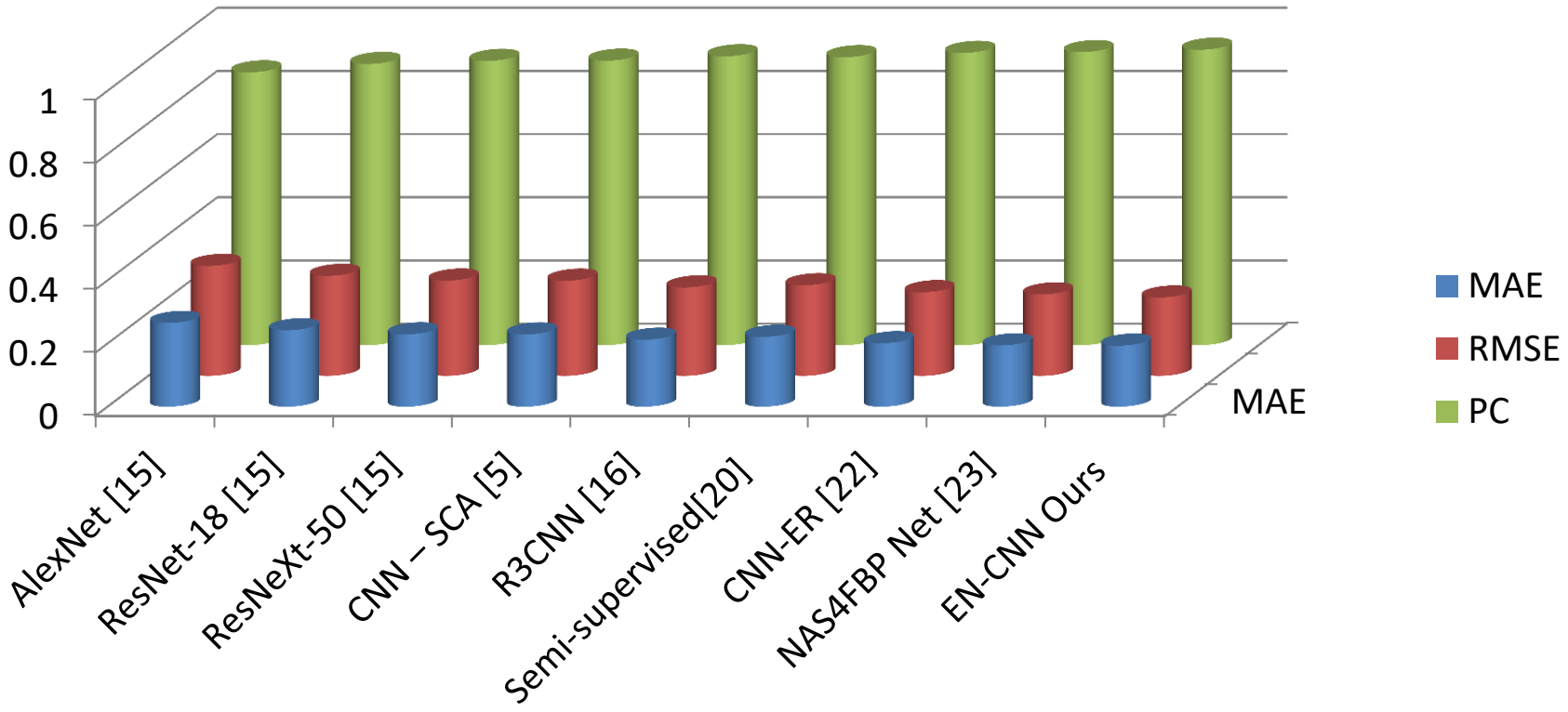


Figure : Performance comparisons on the SCUT-FBP5500 dataset

Conclusion and perspective

- ✓ We studied Convolutional Neural Networks (CNN).
- ✓ In this work, we popose an ensemble of deep CNNs for the facial beauty prediction.
- ✓ we propose a new ensembles are three separate deep convolutional neural networks, each with a unique structural representation built by previously trained models from Inceptionv3, Mobilenetv2 and a new simple network based on Convolutional Neural Networks (CNNs) for facial beauty prediction problem
- ✓ The experimental findings show that our network can perform better than previous CNN baselines approaches.
- ✓ we propose to expand the scope of database and improve network using different architectures collected from Transfomer and ResNeSt.


THANK YOU
For your Attention