

Fine-tuning approach to NIR face recognition

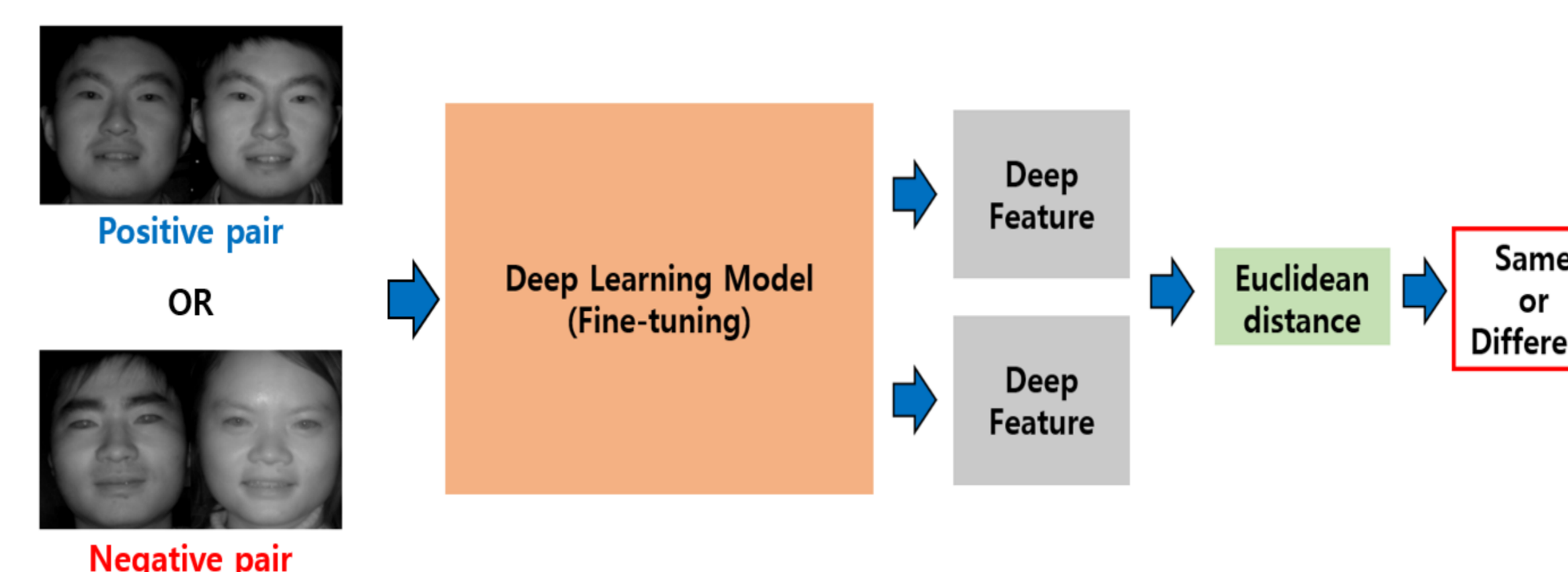
Jeyeon Kim, Hoon Jo, Moonsoo Ra, Whoi-Yul Kim
 Dept. of Electronics and Computer Engineering, Hanyang University, South Korea

Introduction

Motivation

- Due to the active NIR lights, the intensity of the NIR face image changes very slightly in the poor light conditions
- In addition, face recognition (FR) using NIR images is robust to spoofing attack^[1]
- Despite these advantages of NIR FR, the performance of NIR FR is not high enough because the number of training data is relatively limited compared to that of RGB data.
- Our goal is **to overcome this problem by adapting the fine-tuning approach to NIR FR**

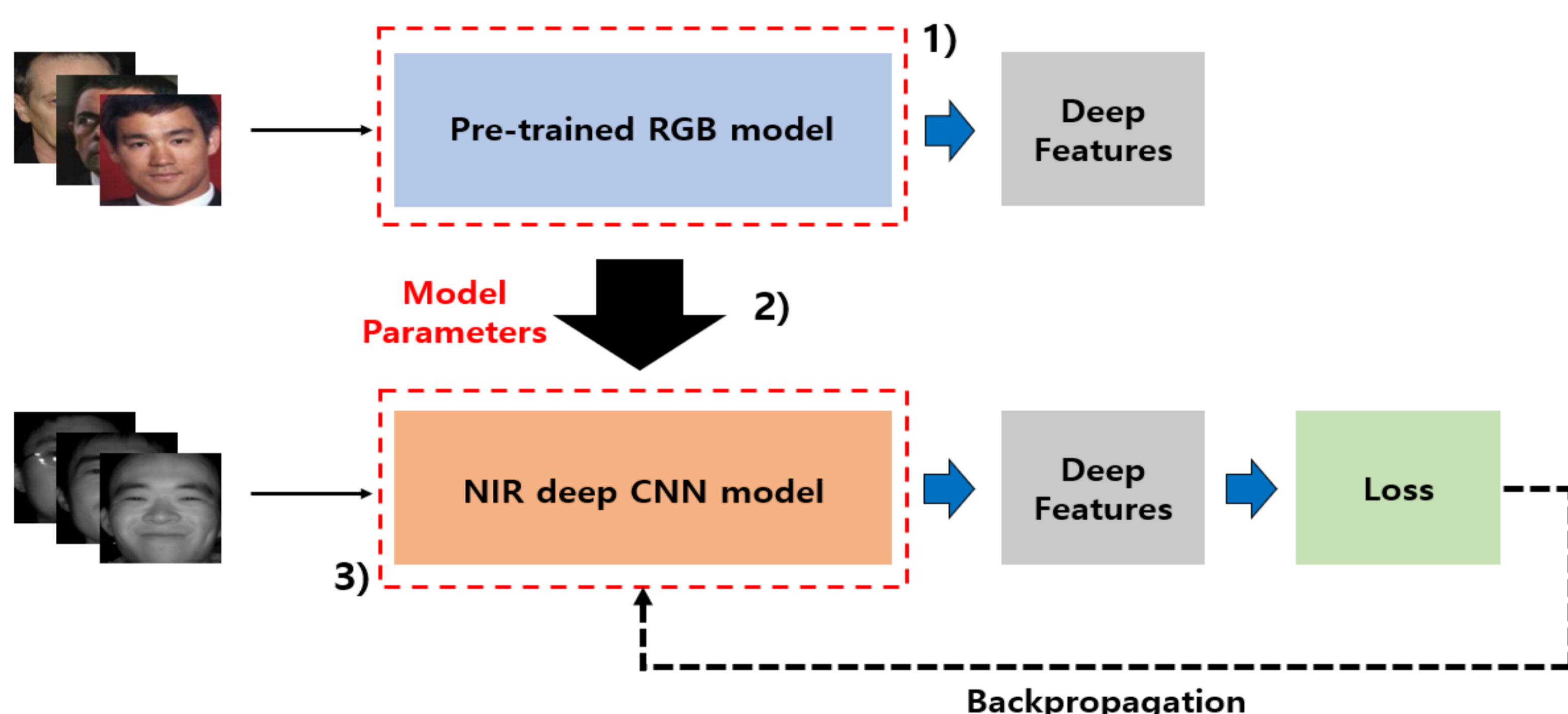
Overall Process of NIR FR



- The pair of two face images is inputted into the deep CNN model for NIR FR
- ✓ Positive pair: same person
- ✓ Negative pair: different person
- The model recognizes whether two face images in the input pair are the same person

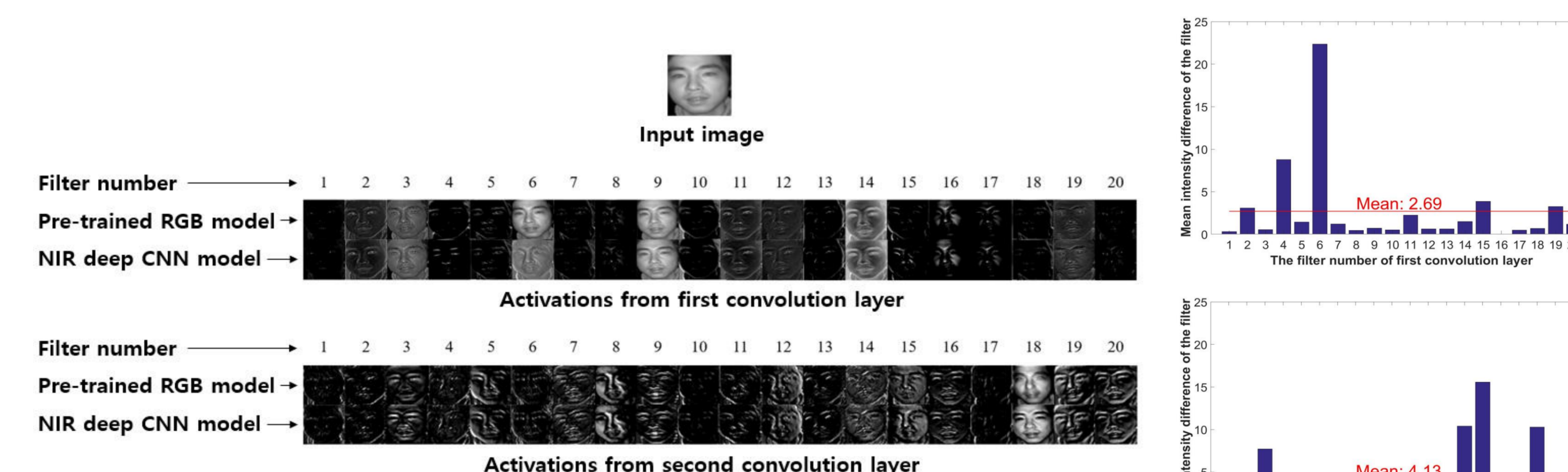
Proposed Fine-tuning Approach

Training Deep CNN Model for NIR FR



Validity of Pre-trained RGB Model

- From the similarity of the activations, we can expect that **the parameters of both models for RGB and NIR FR are highly similar**
- Therefore, the NIR deep CNN model can be trained effectively by utilizing the parameters of the pre-trained model



Construction of Private Face database

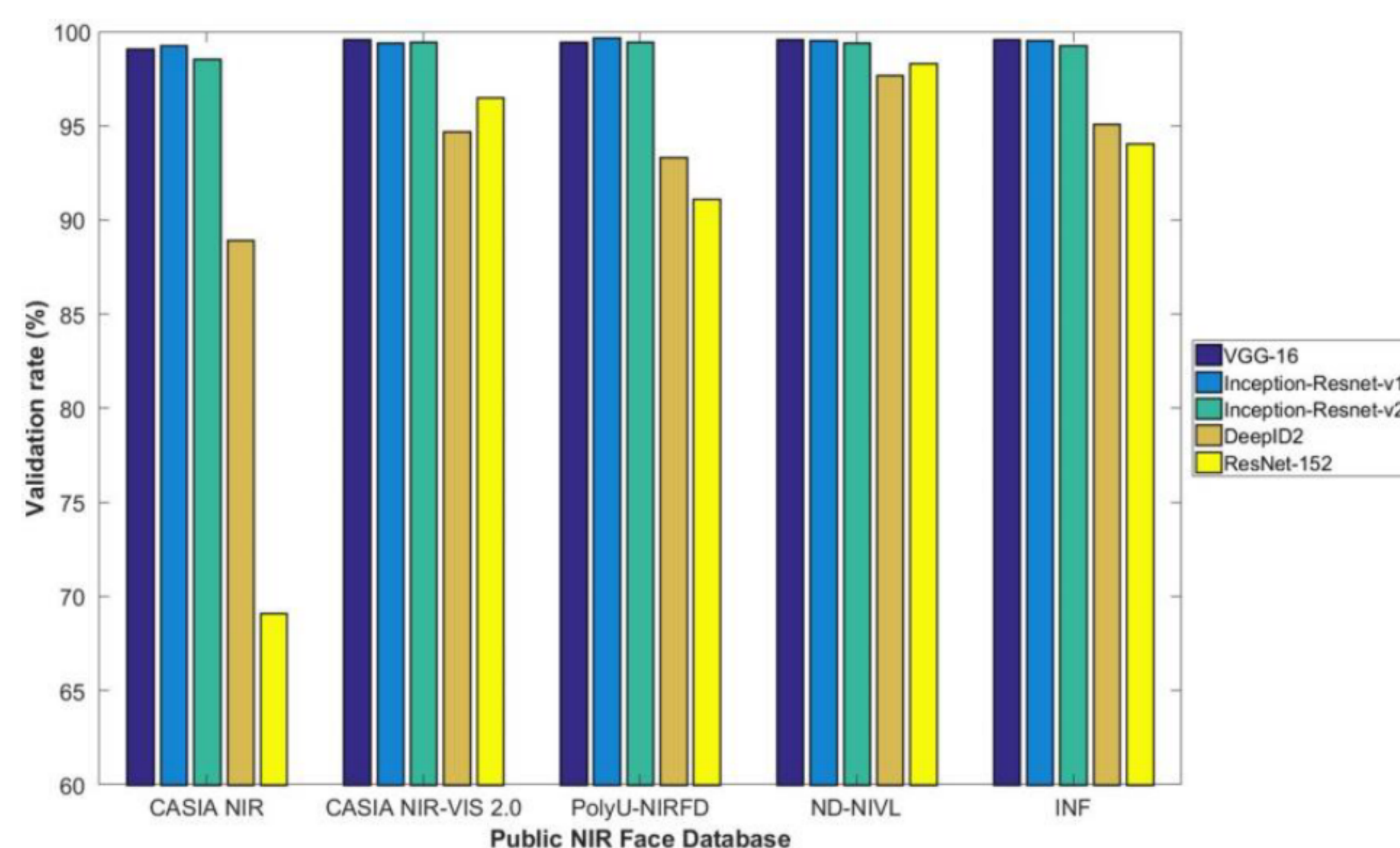
- We constructed the private NIR and RGB face database to compare the performance of NIR and RGB FR in poor lighting conditions



Experimental Results

Performance on Public NIR Face Database

- Inception-Resnet-v1 and VGGNet-16 achieved more than 99% performance on the most public NIR face databases



Comparison with RGB FR

- The performances of the proposed fine-tuning approach and RGB FR in the real-world FR scenario

Method	Accuracy(%)	Validation rate(%)	FAR(%)
NIR FR ^a	96.88	94.47	0.7
RGB FR	71.35	100.00	57.30

^a NIR FR indicates the proposed fine-tuning approach.

- The performances of the proposed fine-tuning approach and RGB FR in the poor lighting conditions

Method	Accuracy(%)	Validation rate(%)	FAR(%)
NIR FR ^a	96.65	84.90	0.1%
RGB FR	86.50	44.03	0.1%

Comparison with Existing Methods

NIR FR methods	Identification rate(%)
Zhang <i>et al.</i> [14]	90.89
Peng <i>et al.</i> [15]	88.65
Fine-tuning (VGG-16)	98.15
Fine-tuning (Inception-Resnet-v1)	97.22
Fine-tuning (Inception-Resnet-v2)	99.67

Conclusion

- We showed the validity of the proposed fine-tuning approach from the similarity between the pre-trained RGB model and the NIR deep CNN model
- High performance of the proposed approach was achieved
- In the future, we will focus on alleviating the sensor dependency of NIR FR