# Moving Toward Unbiased Human Facial Expression Recognition

Ali Pourramezan Fard, M. Mehdi Hosseini and Prof. Mohammad H. Mahoor

Ritchie School of Engineering and Computer Science, University of Denver, CO, USA

How Machine Learning Works

❖ **Data collection:** collecting images through searching the web

❖ **Data labeling:** trained humans annotate images to create a dataset
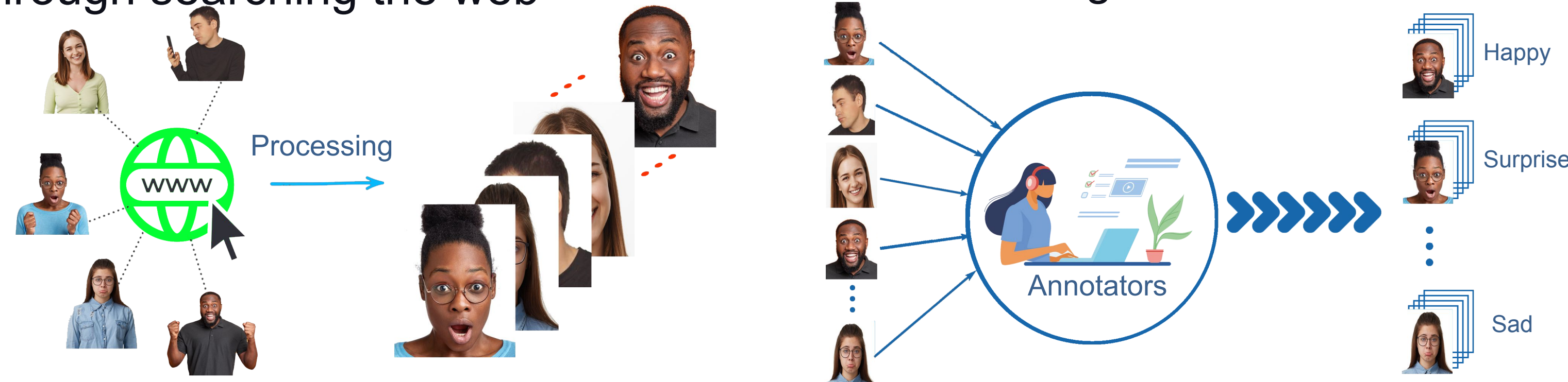
❖ **Training and Prediction:** design a deep neural network and train it using the labeled data
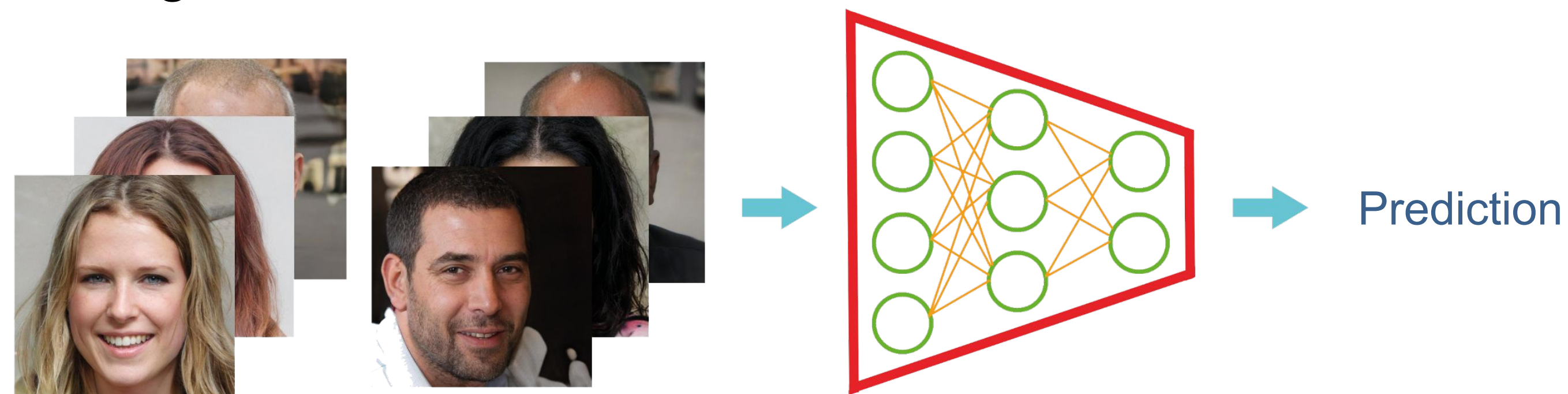
Facial Expression Recognition & Challenges

❖ Automatic Facial Expression Recognition (FER) has a wide range of applications in health, human-computer-interaction, etc.

❖ Almost all the existing FER datasets are unbalanced, and biased.

❖ Hence, machine knowledge will be very limited and biased.

❖ Biased annotator and the ambiguities
  ➤ Annotator uncertainty in the challenging cases

Neutral or Happy?   Neutral or Surprise?

  ➤ Race, gender, age, and other characteristics of an image can impact the labeling

❖ Lack of variation in the existing datasets
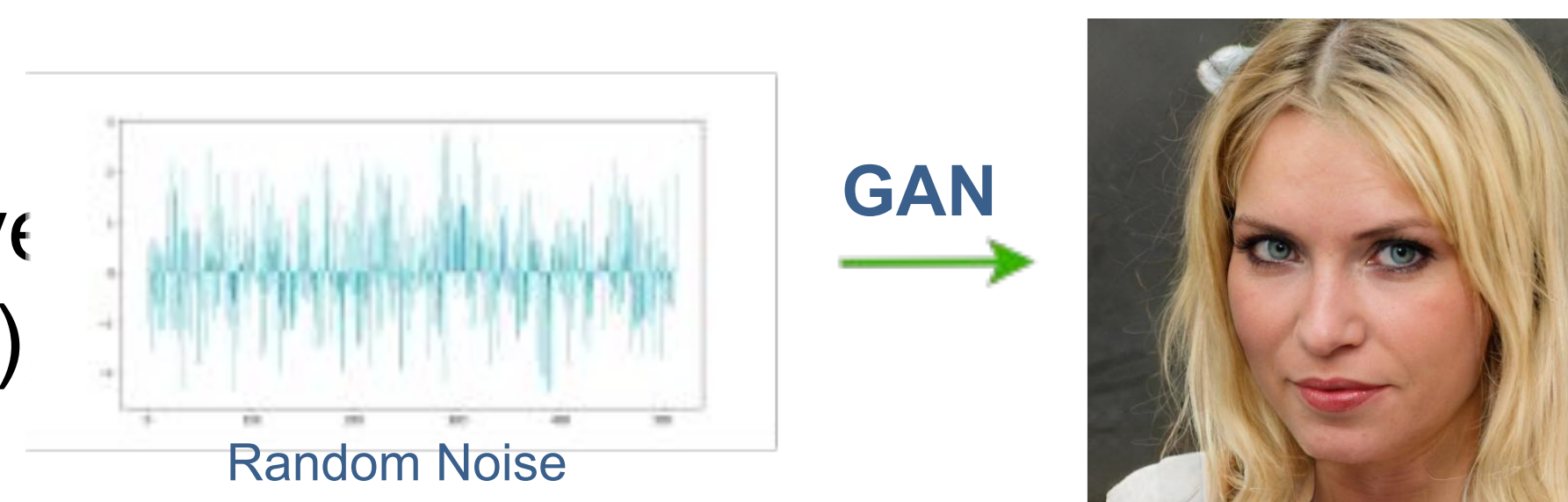 ➤ Some combination of facial attributes are hardly exist in the dataset
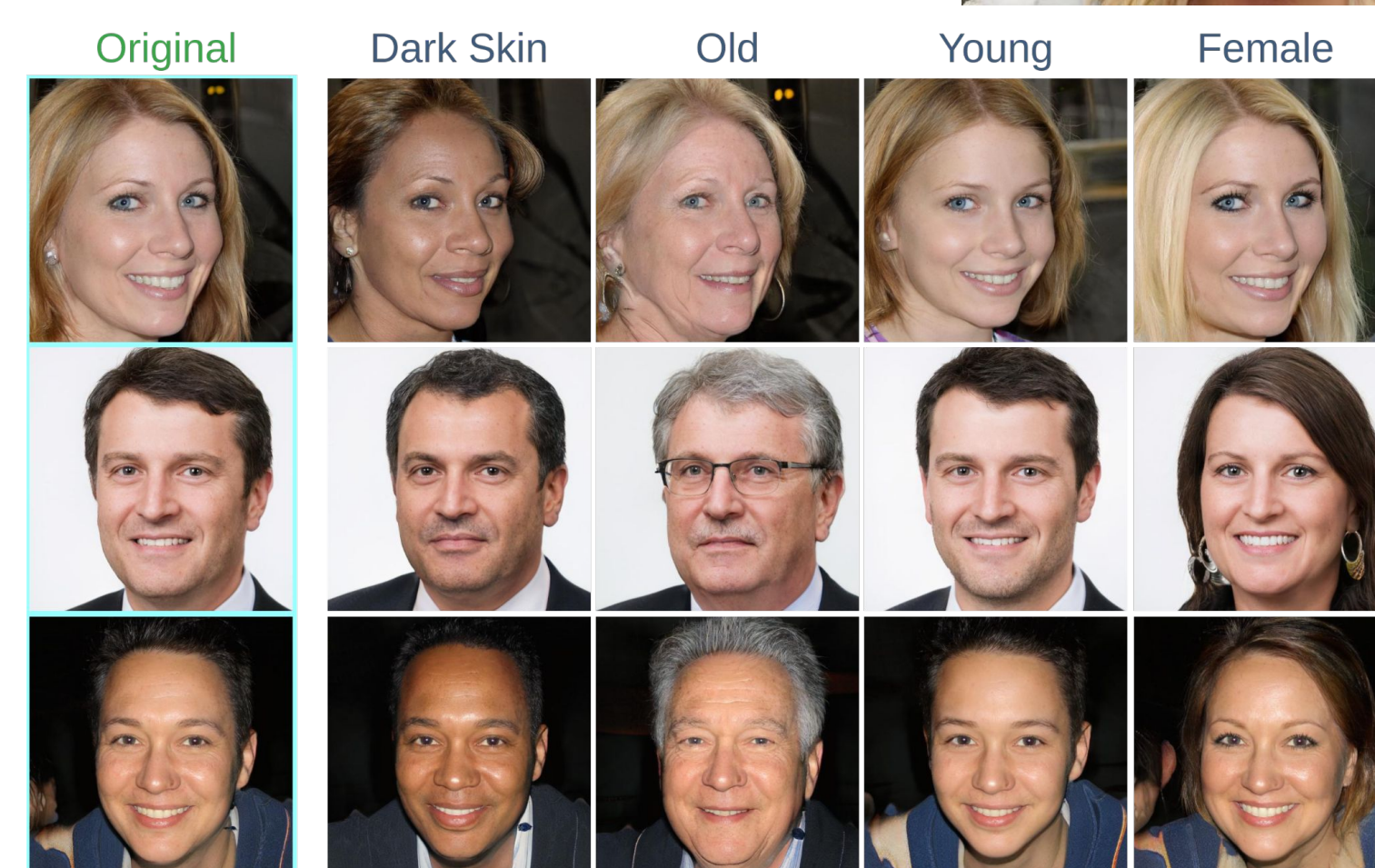
| Female + Anger | Female + Darks Skin | Old + Happy |

Proposed Solution

❖ We used a deep learning algorithm, called Generative Adversarial Network (GAN) to synthesize the faces

Random Noise → **GAN**

Original   Dark Skin   Old   Young   Female

❖ We developed a framework to modify the facial attributes of the generated images

❖ We generated a Balanced dataset, containing 23 different combination of the facial attributes

Female	Old	Young	Black	Male
Female & Anger	Female & Black	Male & Young	Male & Anger	
Female & Young	Female & Old	Male & Old	Male & Black	
Female & Black & Old	Female & Black & Young	Male & Black & Old	Male & Black & Young	
Female & Anger & Young	Female & Anger & Old	Male & Anger & Young	Male & Anger & Old	
Female & Anger & Black			Male & Anger & Black	

❖ Our balanced dataset is practical for other problems, such as age detection, facial emotion recognition, race prediction, and psychological studies.

❖ Using our balanced dataset, we are designing a deep neural network for automatic facial emotion recognition.