



Introduction to Artificial Intelligence and CV Applications

Speaker: 蘇佳益

Advisor: 陳聰毅

國立高雄科技大學電子工程系

Agenda

- Course Introduction
- Artificial Intelligence
- Machine Learning
- PULSE: Self-Supervised Photo Upsampling via Latent Space Exploration of Generative Models
- SynSin: End-to-end View Synthesis from a Single Image
- PIFuHD: Multi-Level Pixel-Aligned Implicit Function for High-Resolution 3D Human Digitization
- Wish You Were Here: Context-Aware Human Generation
- Detectron2: A PyTorch-based modular object detection library
- References



Course Introduction

Course Information

- This course will cover
 - Some AI applications
 - Machine Learning algorithms
 - Deep Learning algorithms
 - NLP models
 - NLP applications

Tutorials for Implementing Algorithm

- Python Tutorials
 - <http://cs231n.github.io/python-numpy-tutorial/>
 - <http://web.stanford.edu/class/cs224n/readings/python-review.pdf>
- Pytorch Tutorial
 - <https://pytorch.org/tutorials/>
- Tensorflow Tutorial
 - <https://www.tensorflow.org/tutorials>

Online Lectures

- CS230 Deep Learning – Stanford University
 - <https://cs230.stanford.edu/>
- EECS 498-007 / 598-005 Deep Learning for Computer Vision – University of Michigan
 - <https://web.eecs.umich.edu/~justincj/teaching/eecs498/FA2020/>
- CS221: Artificial Intelligence: Principles and Techniques – Stanford University
 - <https://stanford-cs221.github.io/autumn2019/#schedule>
- CS224n: Natural Language Processing with Deep Learning – Stanford University
 - <http://web.stanford.edu/class/cs224n/>
- CS231n: Convolutional Neural Networks for Visual Recognition – Stanford University
 - <http://cs231n.stanford.edu/>
- 11-411: Natural Language Processing – CMU
 - <http://demo.clab.cs.cmu.edu/NLP/#overview>
- Neural Network for NLP – CMU
 - <http://www.phontron.com/class/nn4nlp2019/description.html>

Free Books

- Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning.
 - <https://www.deeplearningbook.org/>
- Dan Jurafsky and James H. Martin, Speech and Language Processing.
 - <https://web.stanford.edu/~jurafsky/slp3/>



Artificial Intelligence

AI is every where.

e-rater® Auto
DoNotPay

The V Robo

The DoNotPay app
robot lawyer. Fight
and sue anyone c

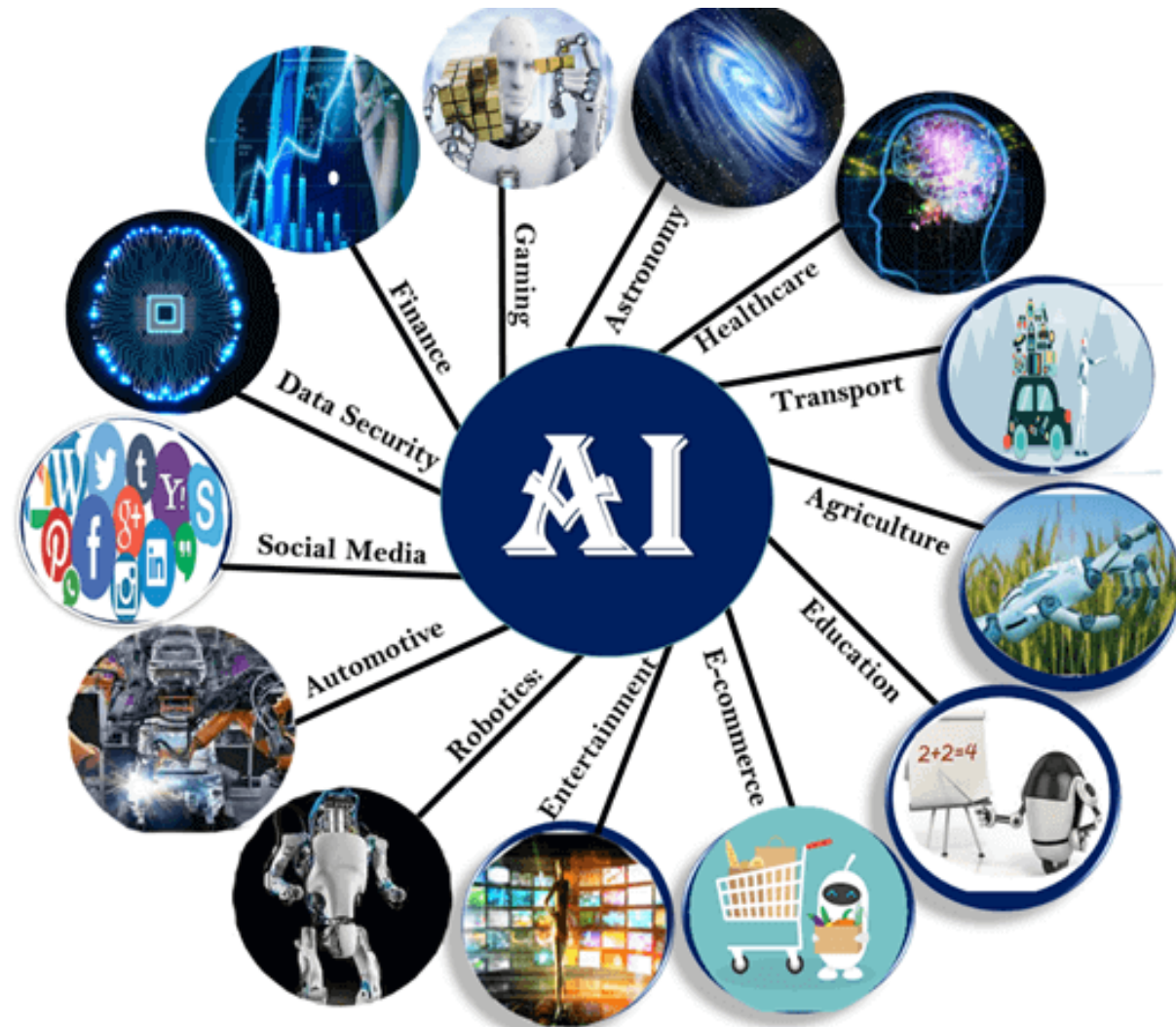
Sign Up/Login

THINGS YOU CAN DO

Auton

Using the
™ Online
assesses
the analy

How Can the e-i



Now!

d to

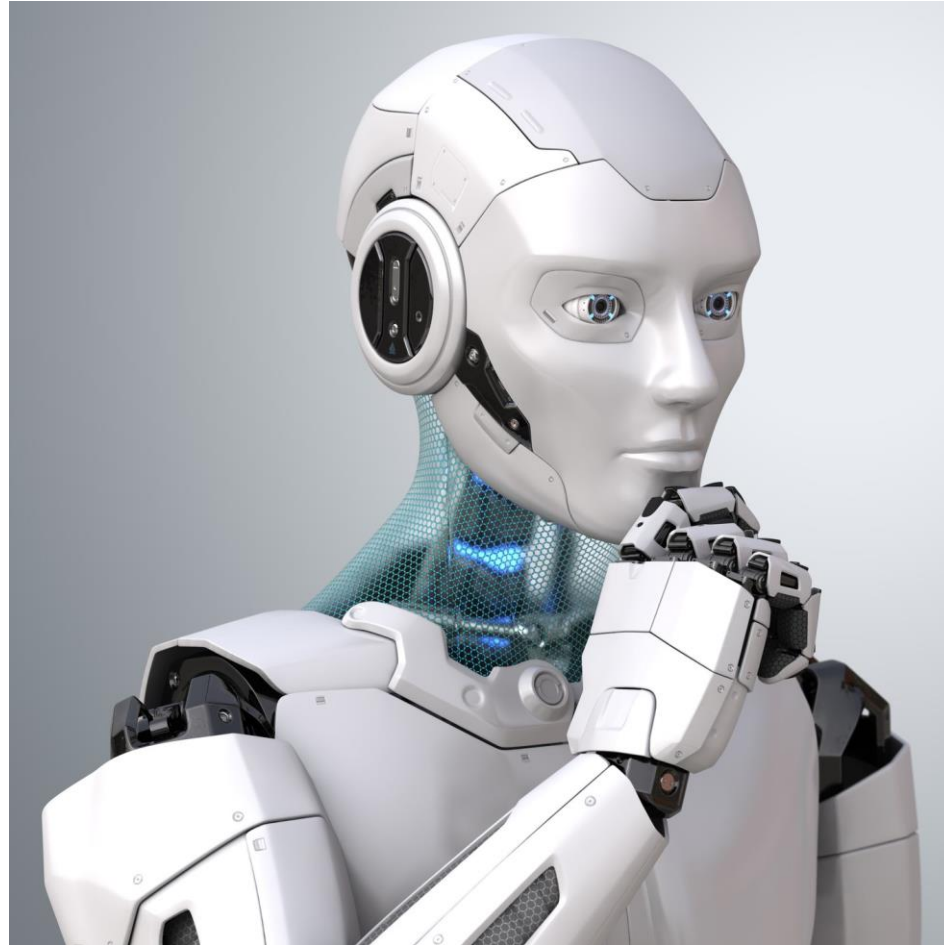
Turing Test

If Interrogators cannot differentiate the difference between human and computer, then test passes.

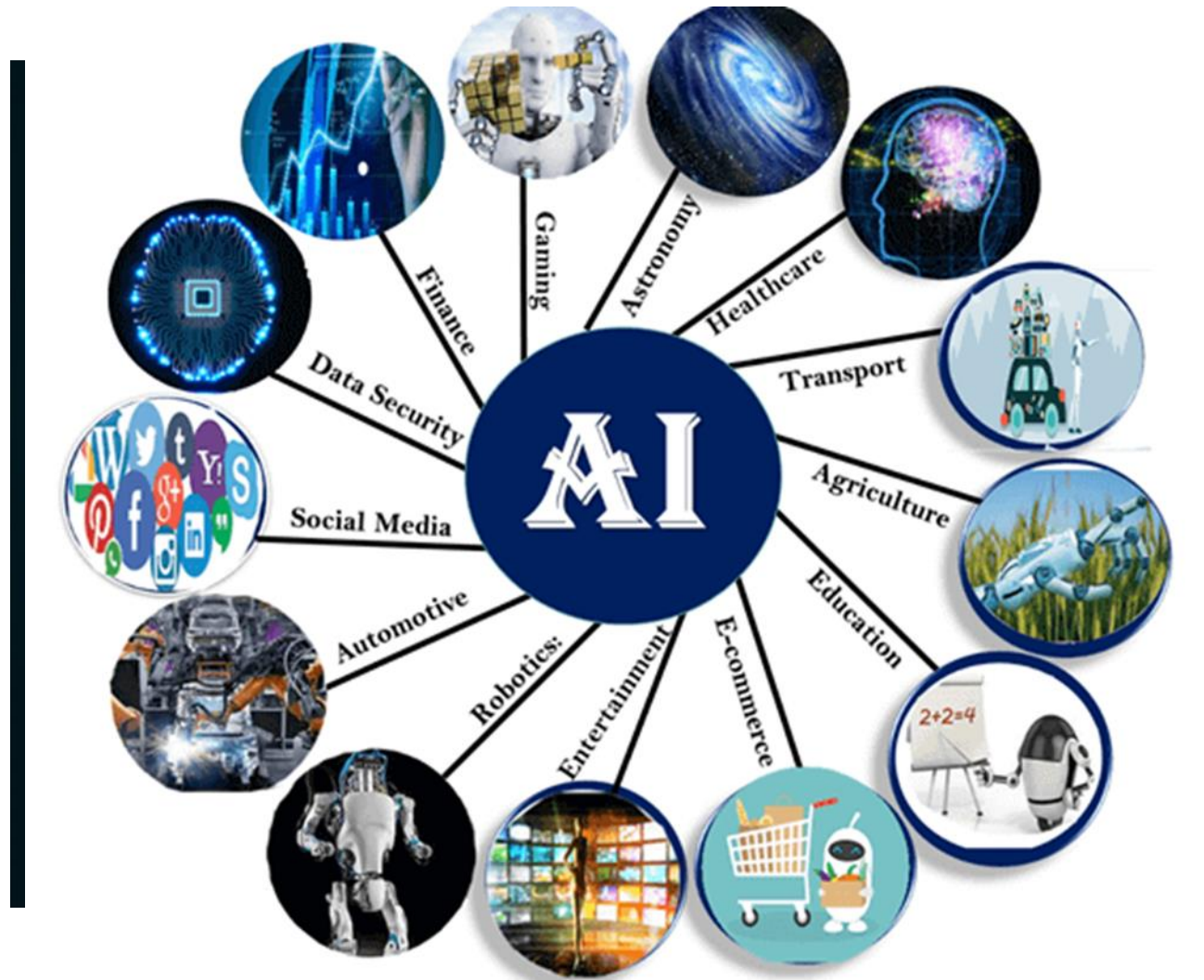
Two types of AI

- Strong AI
- Weak AI

Difference between Strong AI and Weak AI



Two Views of AI



What is the intelligence?



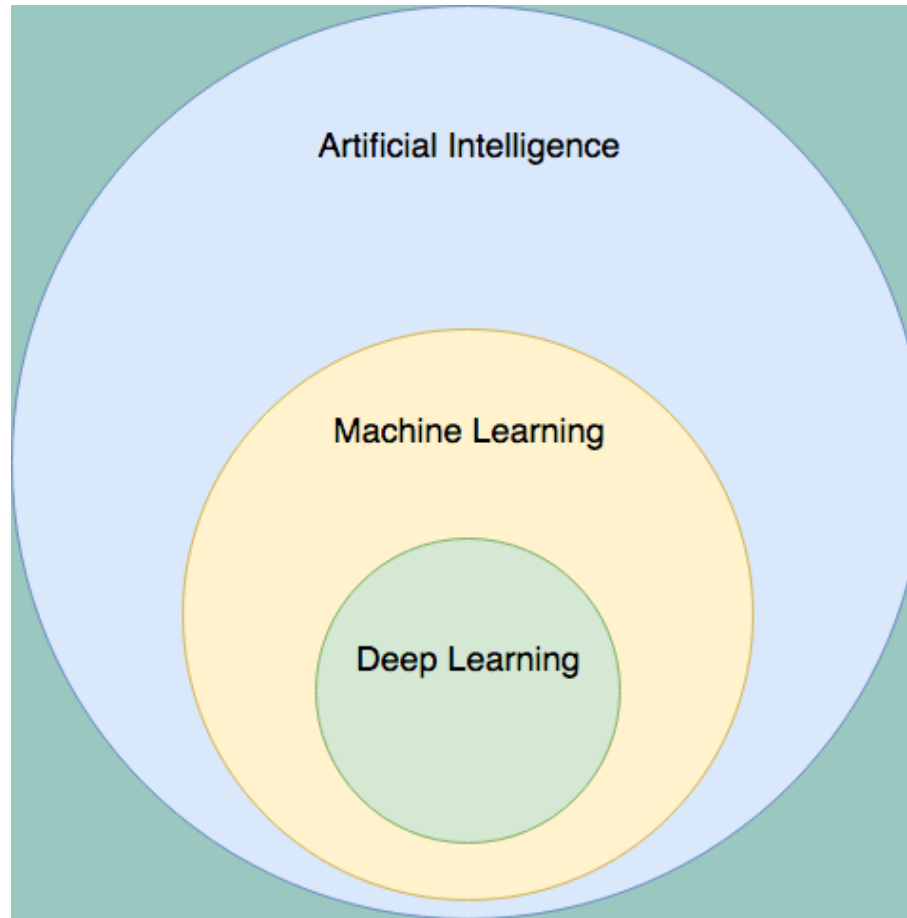


Machine Learning

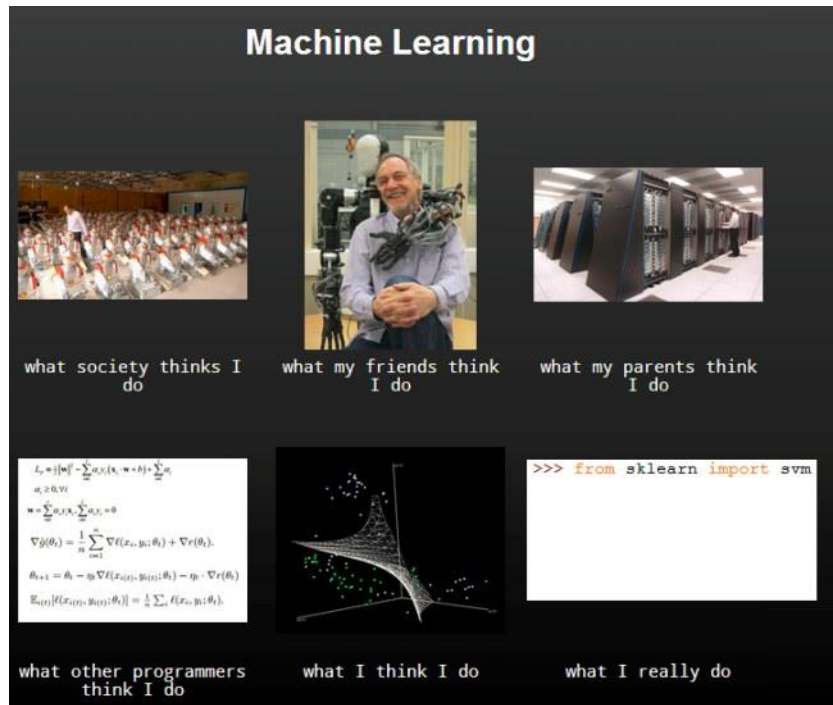
What is Machine Learning?



Venn Diagram of Machine Learning



Definition of Machine Learning



- Tom Mitchell(1998) : A computer is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, with experience E.

Why Machine Learning?

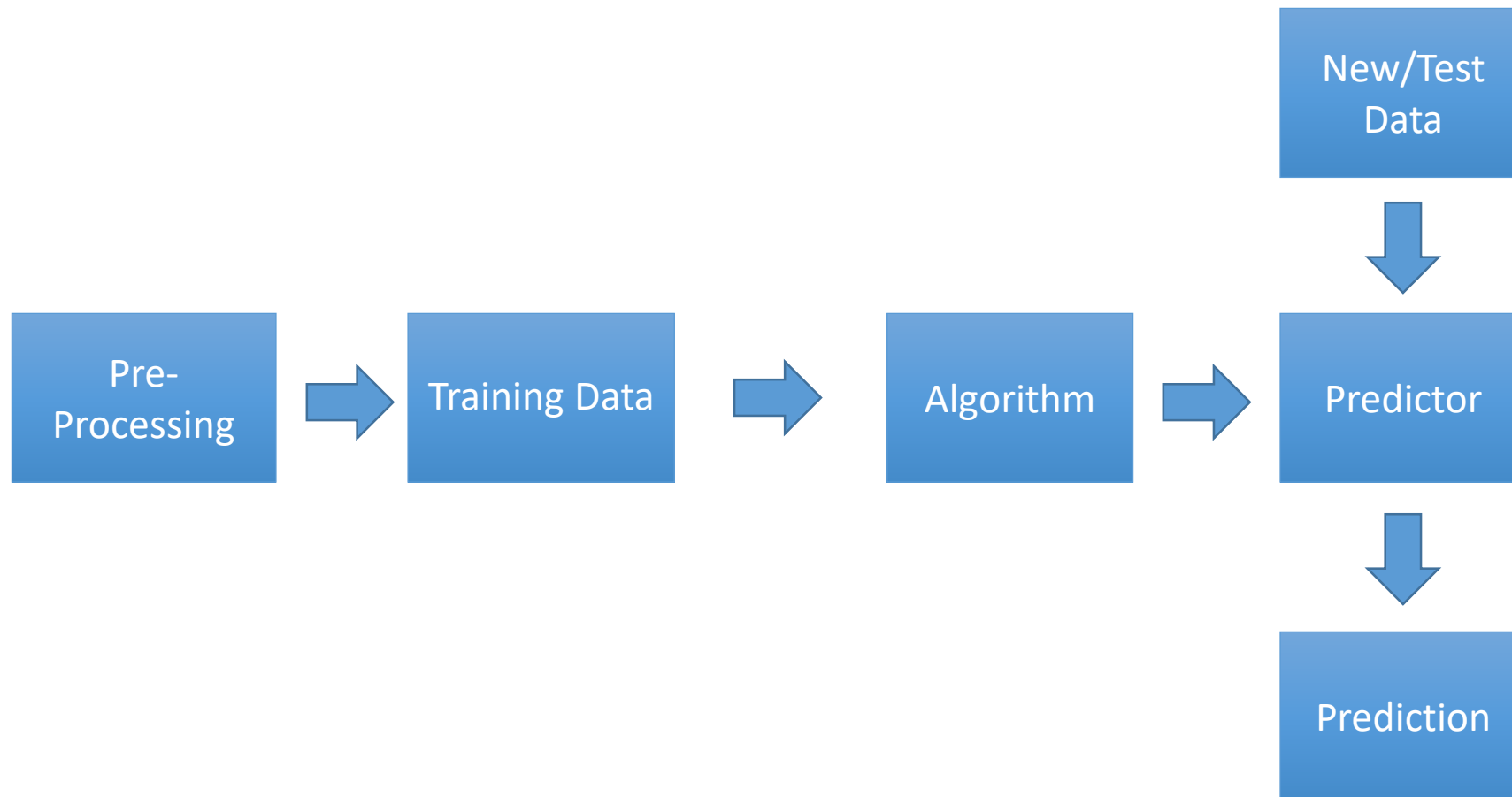


- 您購買的東西已經送達超商，請您來領取。(Spam? Not Spam?)
- 我們這有非常好吃的蔬菜，請您來購買。(Spam? Not Spam?)

Types of Machine Learning

- Supervised Learning
 - Regression
 - Classification
- Unsupervised Learning
 - Clustering
- Reinforcement Learning
- Self-Supervised Learning (More Recently)

Flow of Machine Learning



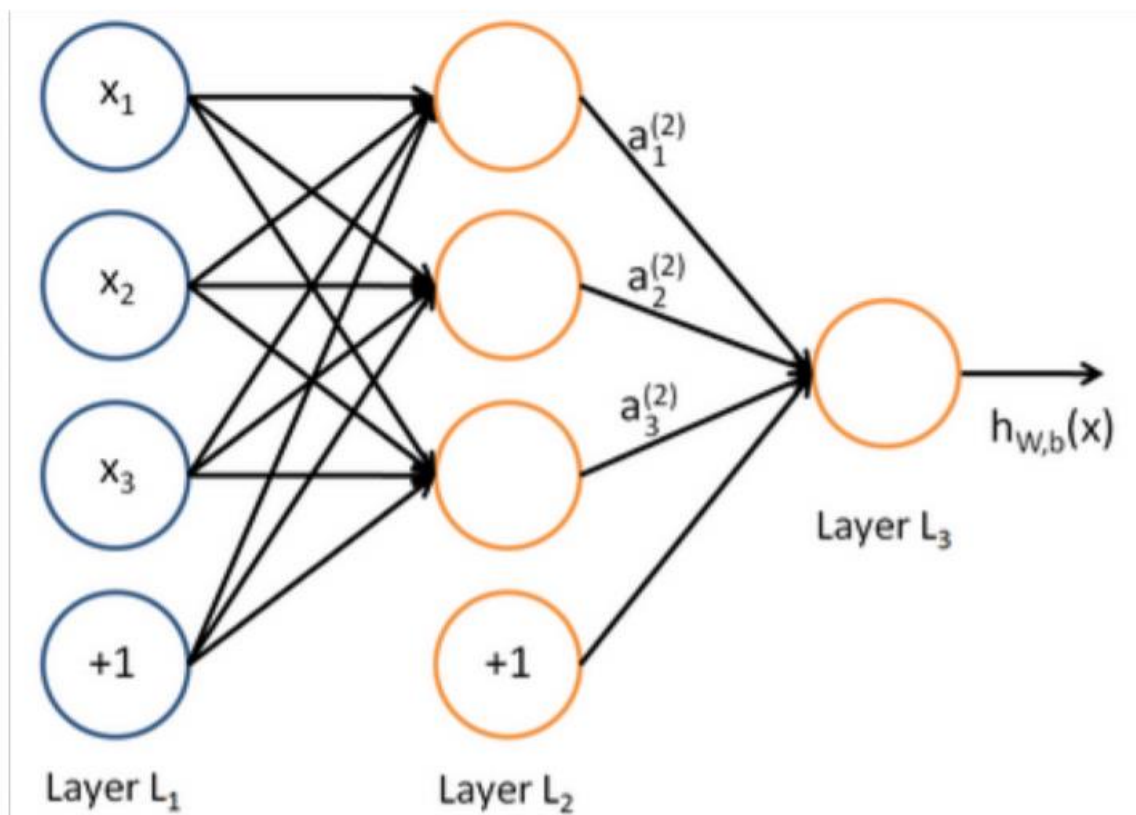
Classification

- Supervised Learning
- Trained with Labeled Data
- Algorithm
 - Naïve Bayes
 - Logistic Regression
 - KNN
 - SVM
 - Neural Network
- Application
 - Text Classification
 - Image Classification

Clustering

- Unsupervised Learning
- Trained with Unlabeled Data
- Algorithm of Clustering
 - K-means
 - Affinity Propagation
 - Neural Network
- Application
 - Recommendation System
 - Word Sense Induction

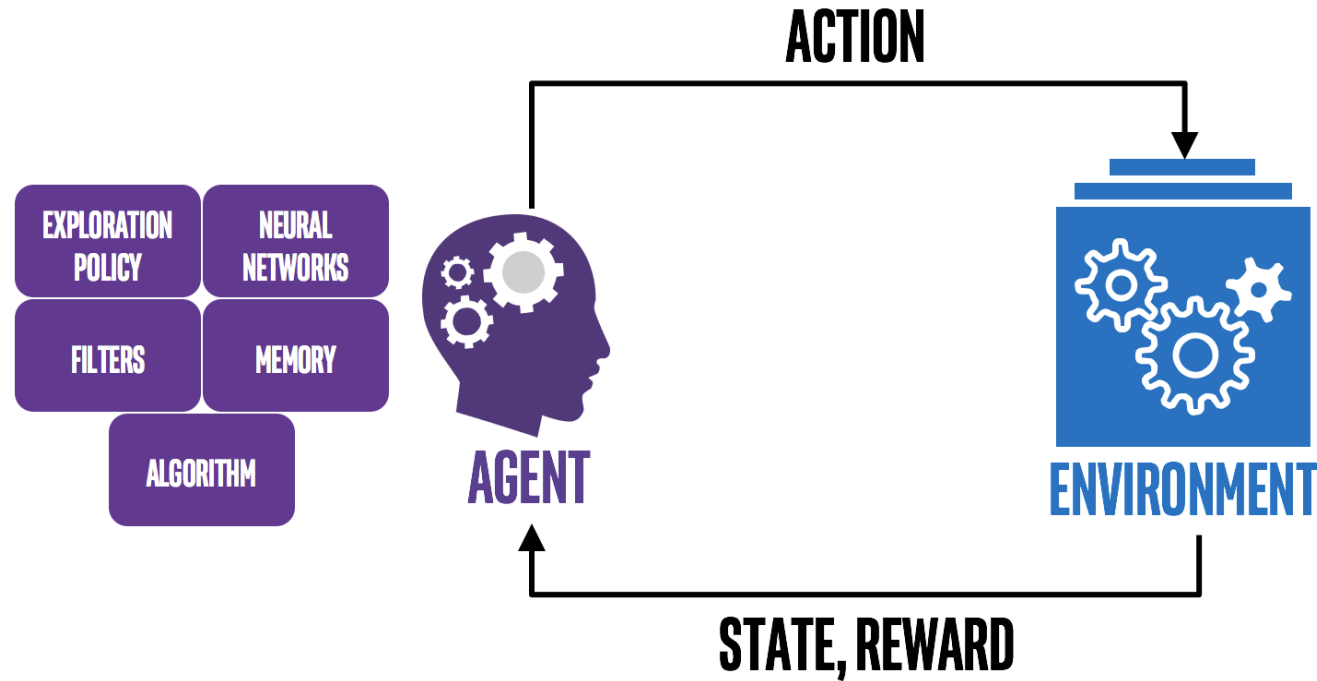
Deep Learning



$$h_{w,b}(x) = f(w^T x + b)$$

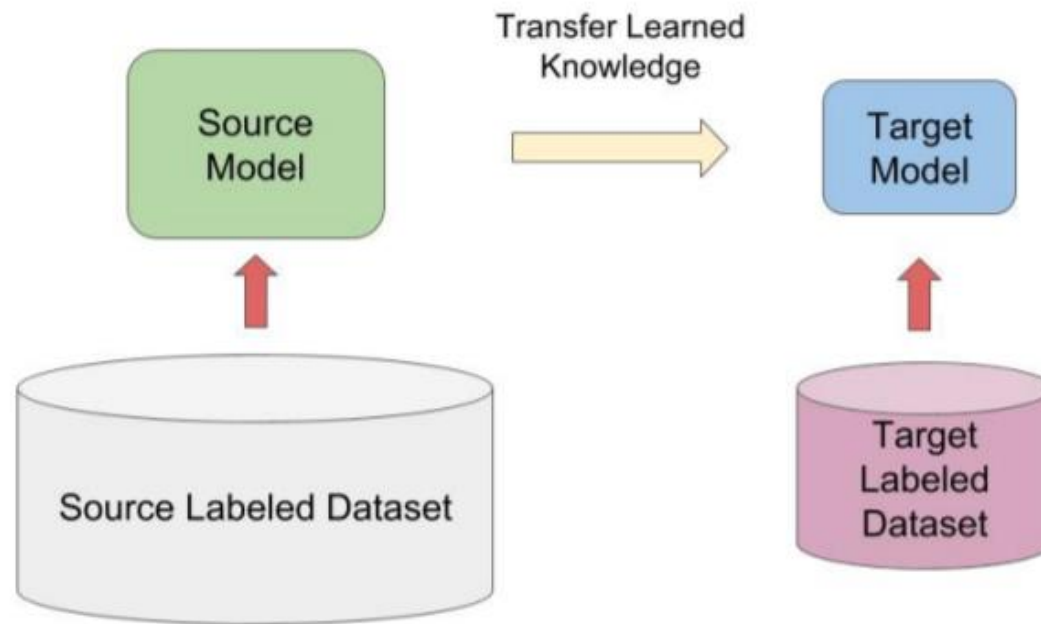
$$f(z) = \frac{1}{1 + e^{-z}}$$

Reinforcement Learning



- Application
 - AlphaGo

Self-Supervised Learning



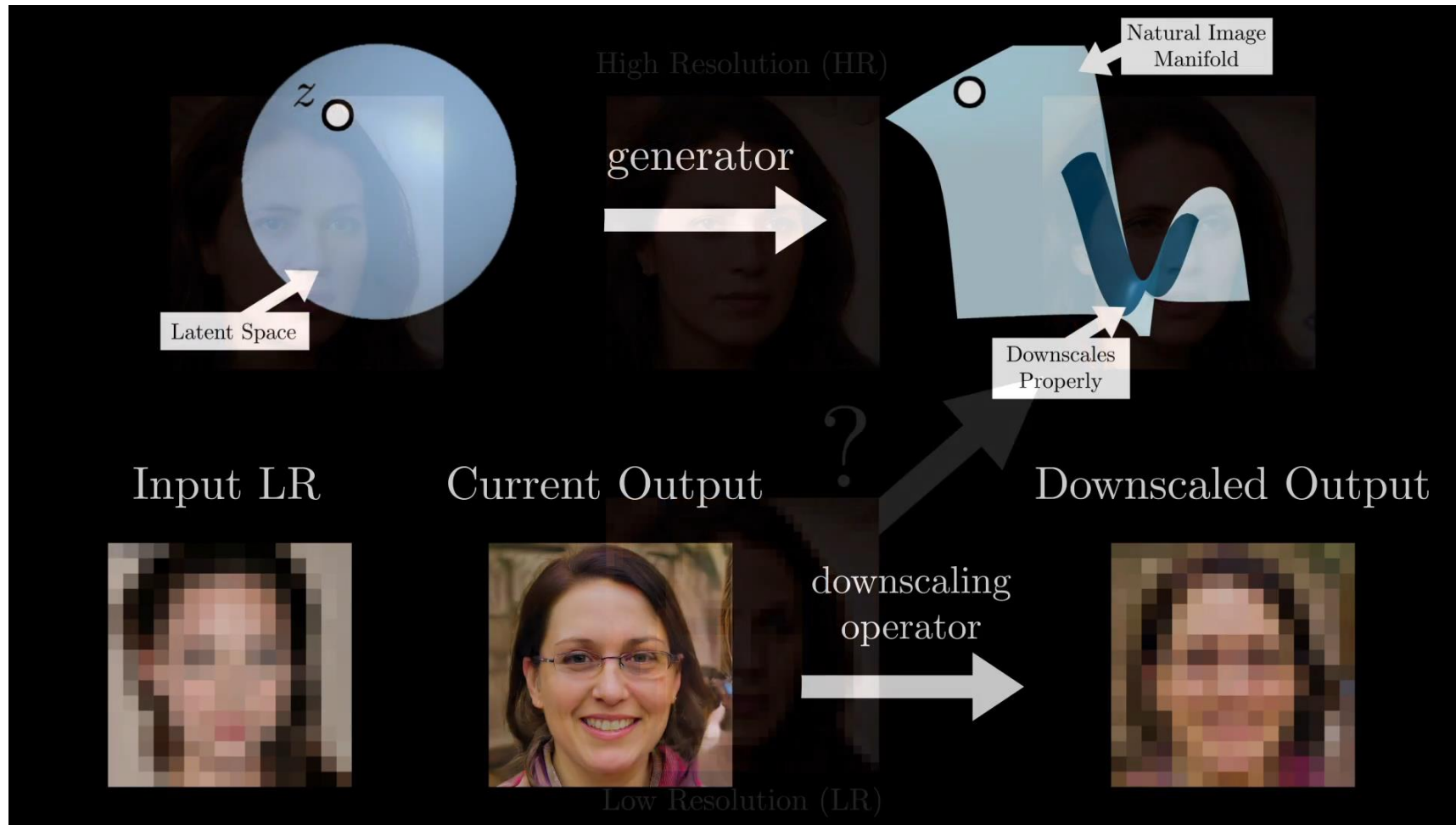
- Source: <http://web.stanford.edu/class/cs224n/slides/cs224n-2020-lecture14-contextual-representations.pdf>



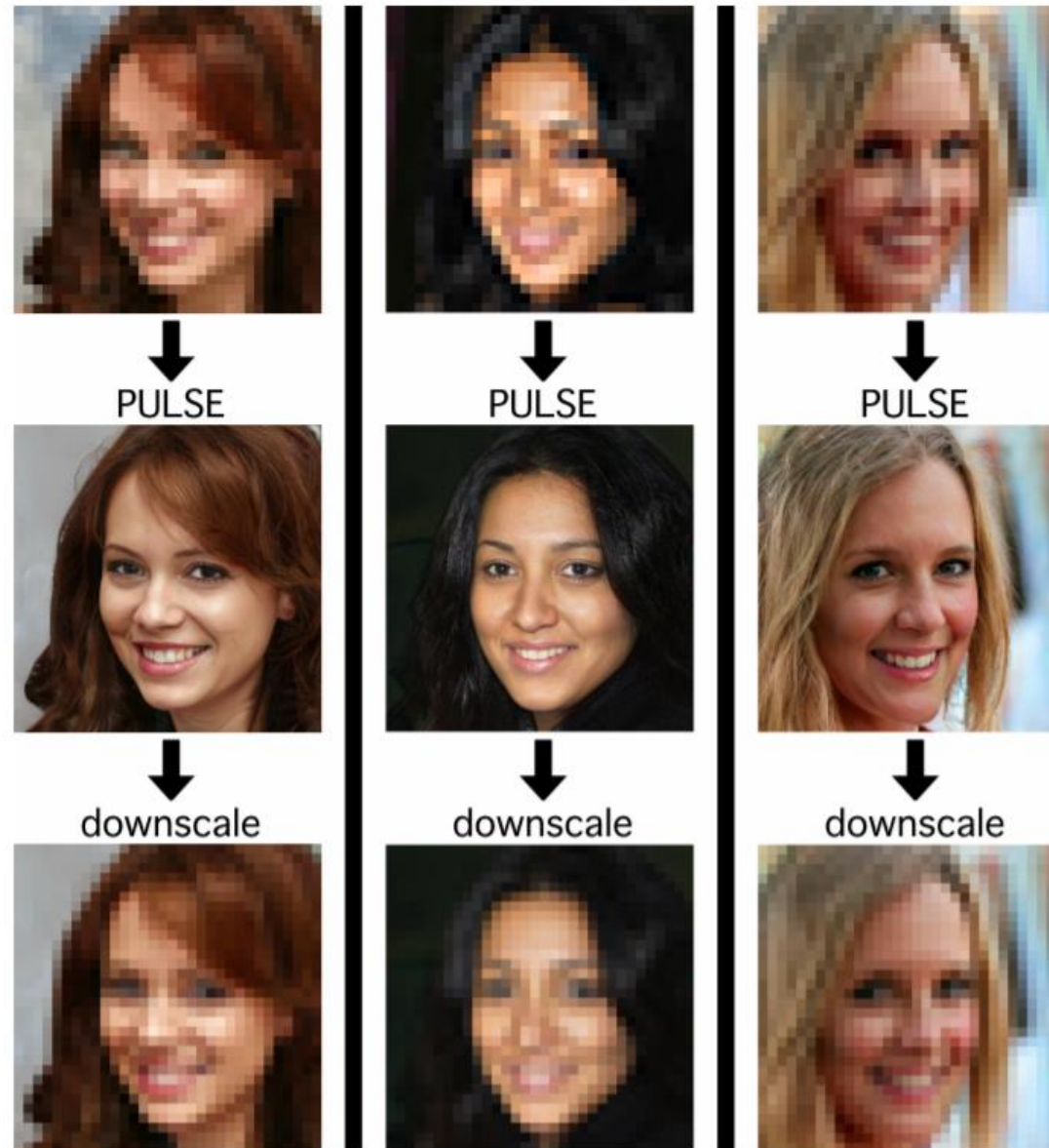
PULSE: Self-Supervised Photo Upsampling via Latent Space Exploration of Generative Models

Menon et al., CVPR, 2020.

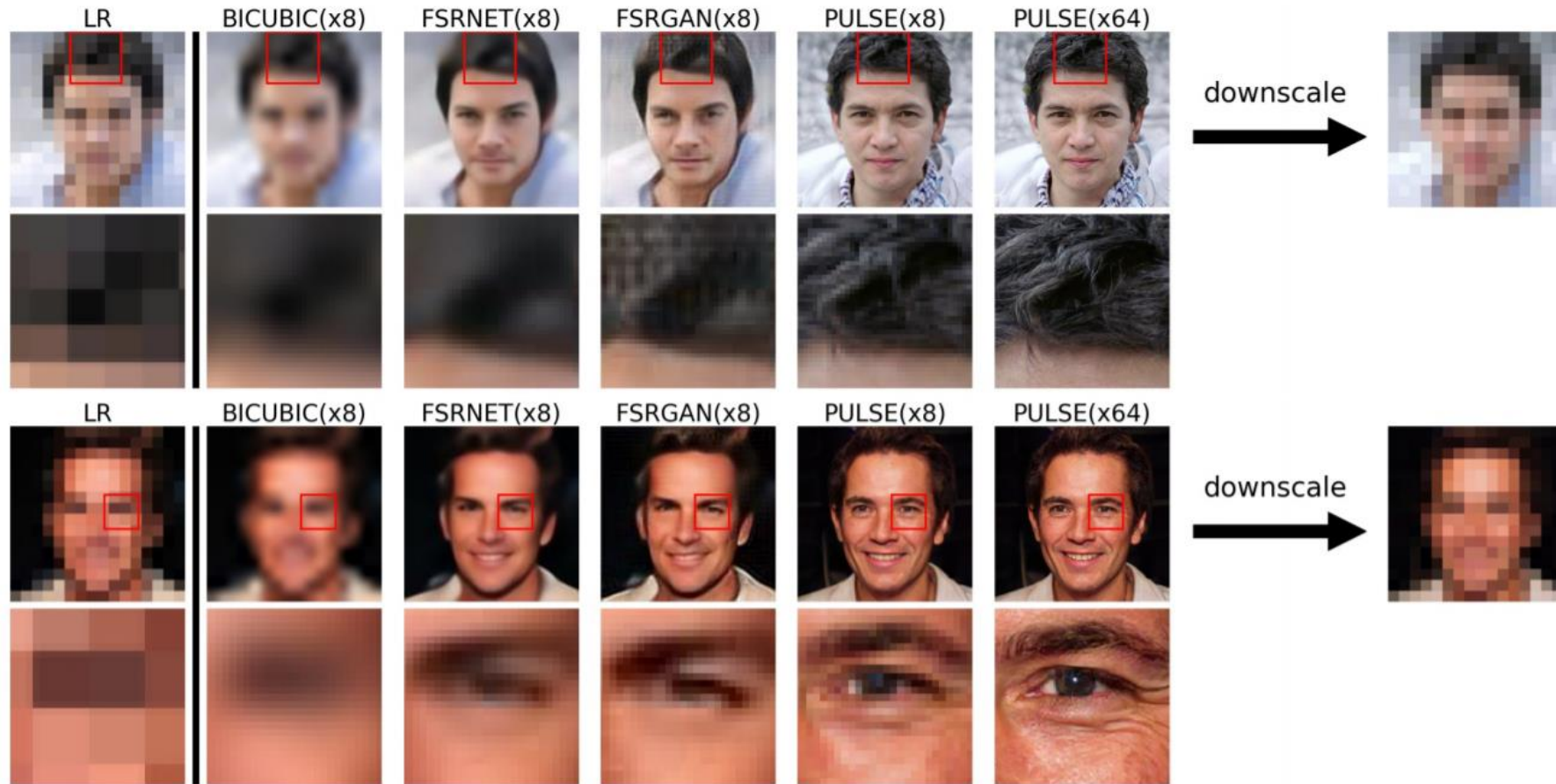
Method



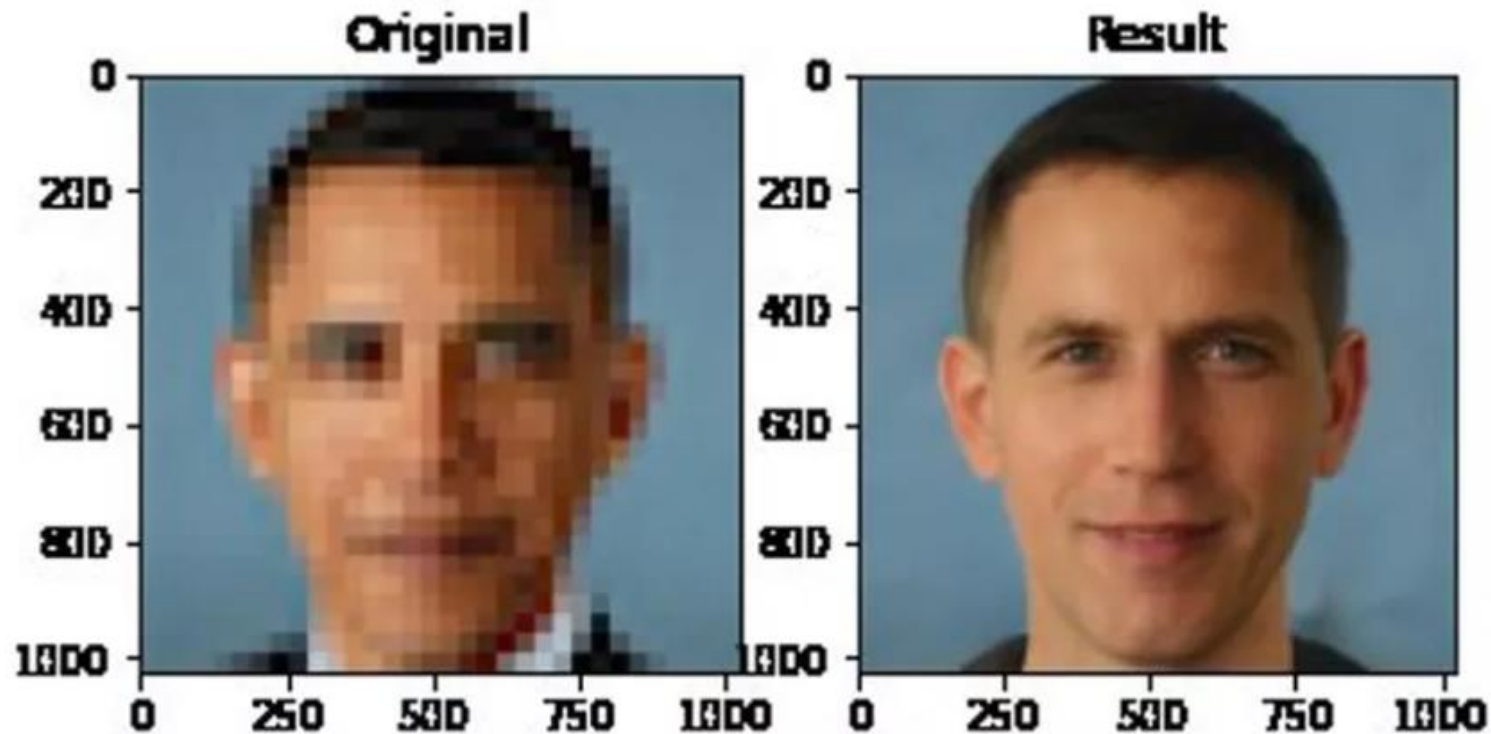
Results



Comparison with Other Methods



Bias in this Research (Obama)



- Source: <https://www.theverge.com/21298762/face-depixelizer-ai-machine-learning-tool-pulse-stylegan-obama-bias>

Reasons to the Bias

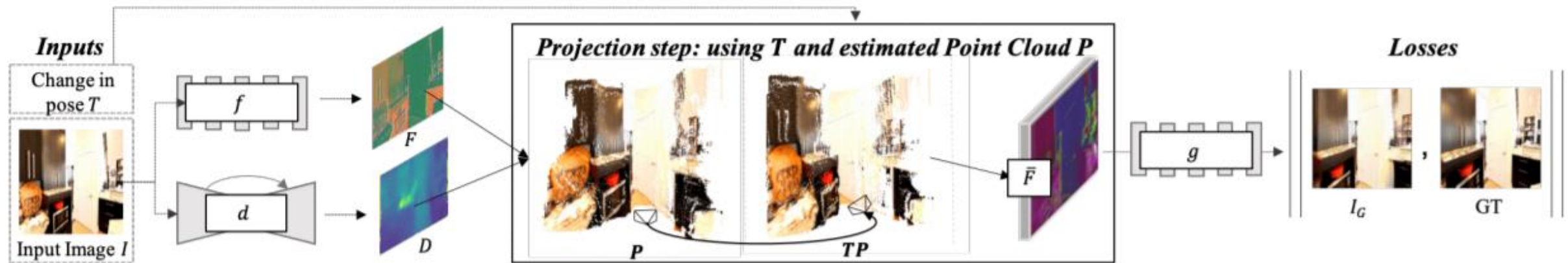
- Researchers
- Algorithm
- Data



SynSin: End-to-end View Synthesis from a Single Image

Wiles et al., CVPR, 2020.

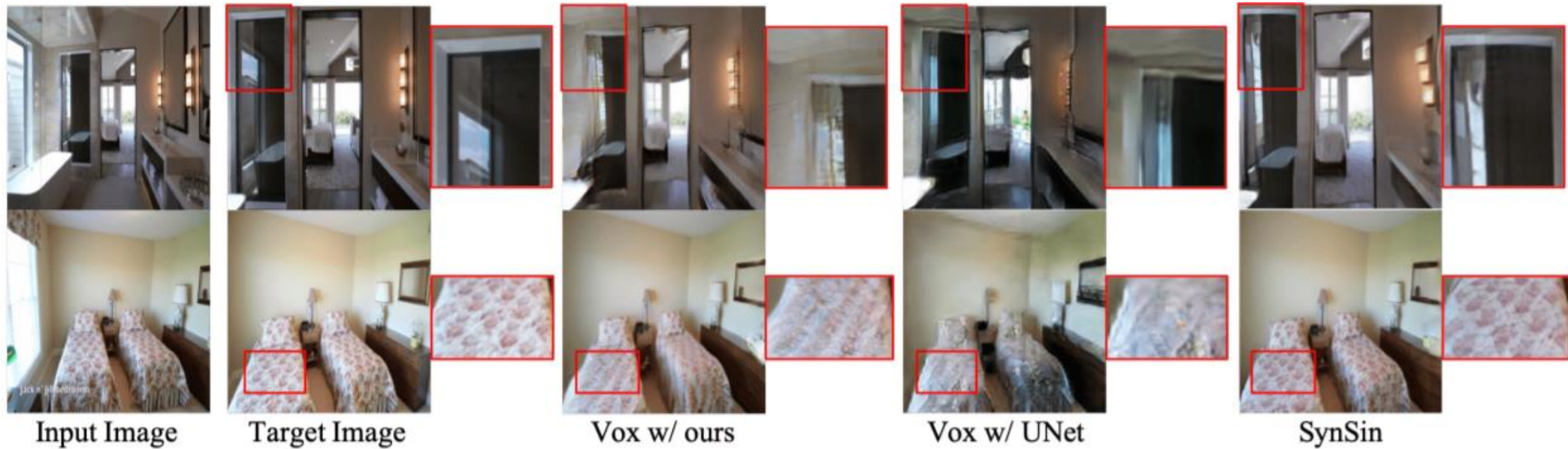
Method



Results



Comparison with other Methods

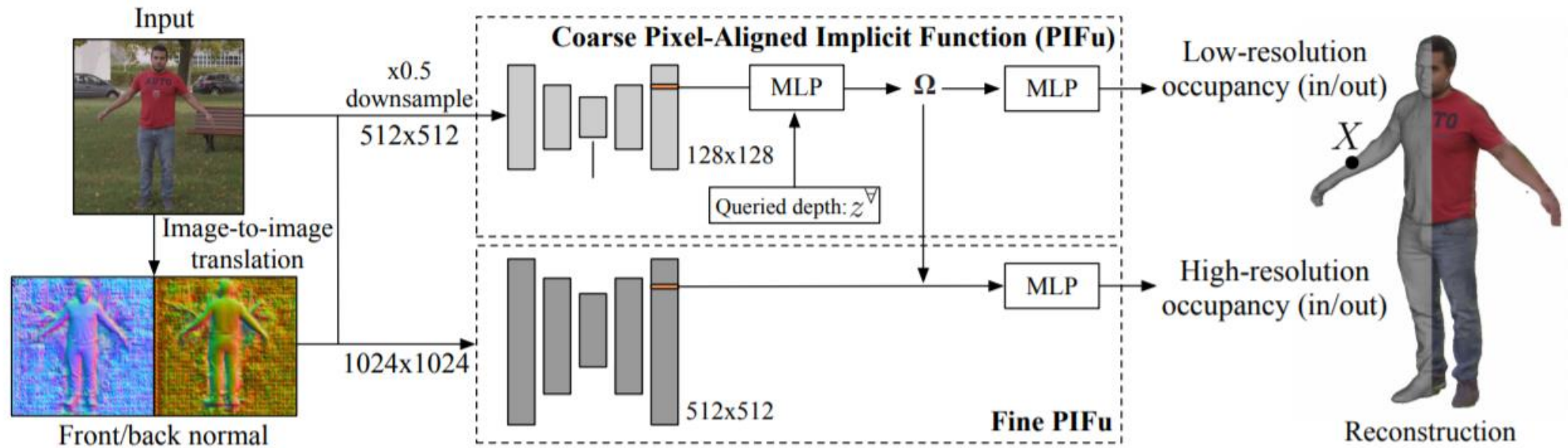




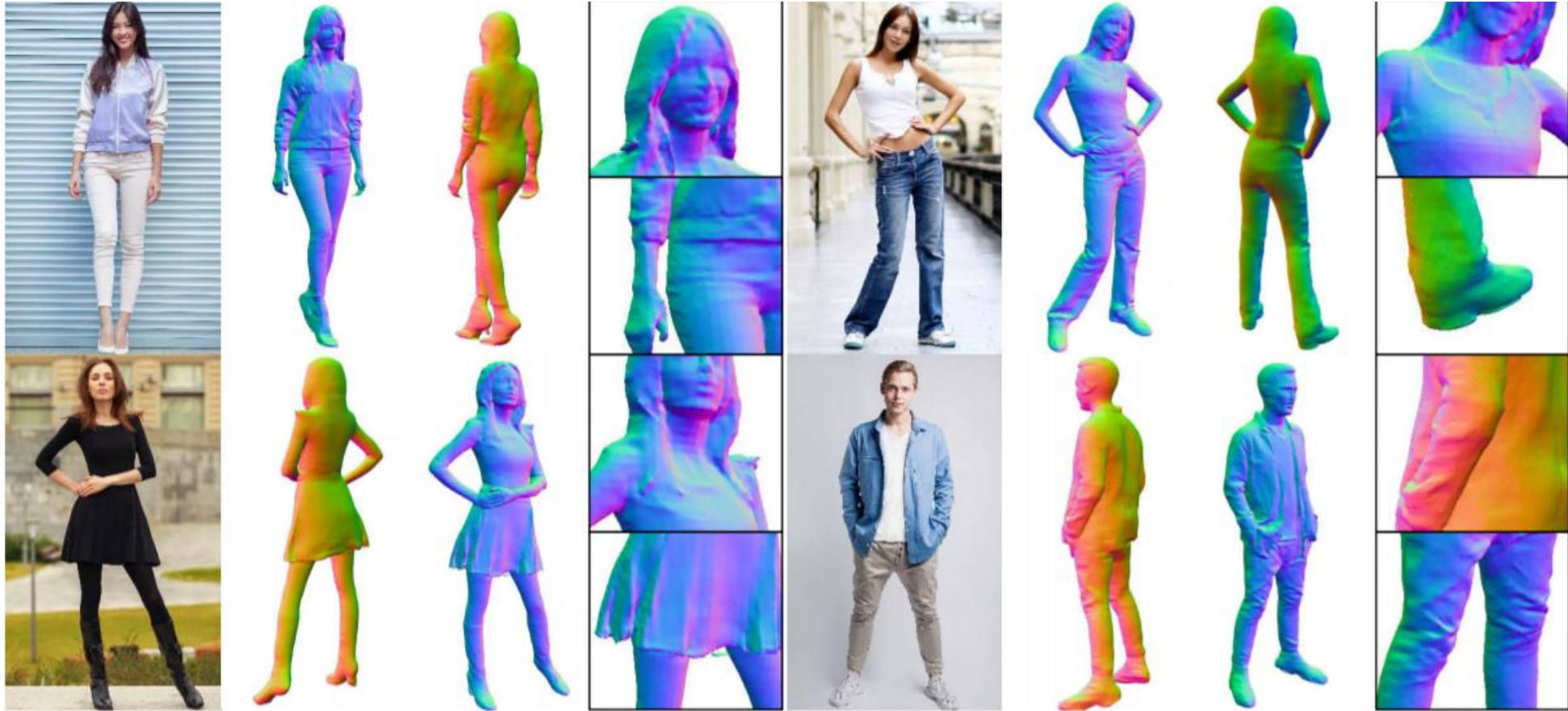
PIFuHD: Multi-Level Pixel-Aligned Implicit Function for High-Resolution 3D Human Digitization

Saito et al., CVPR, 2020.

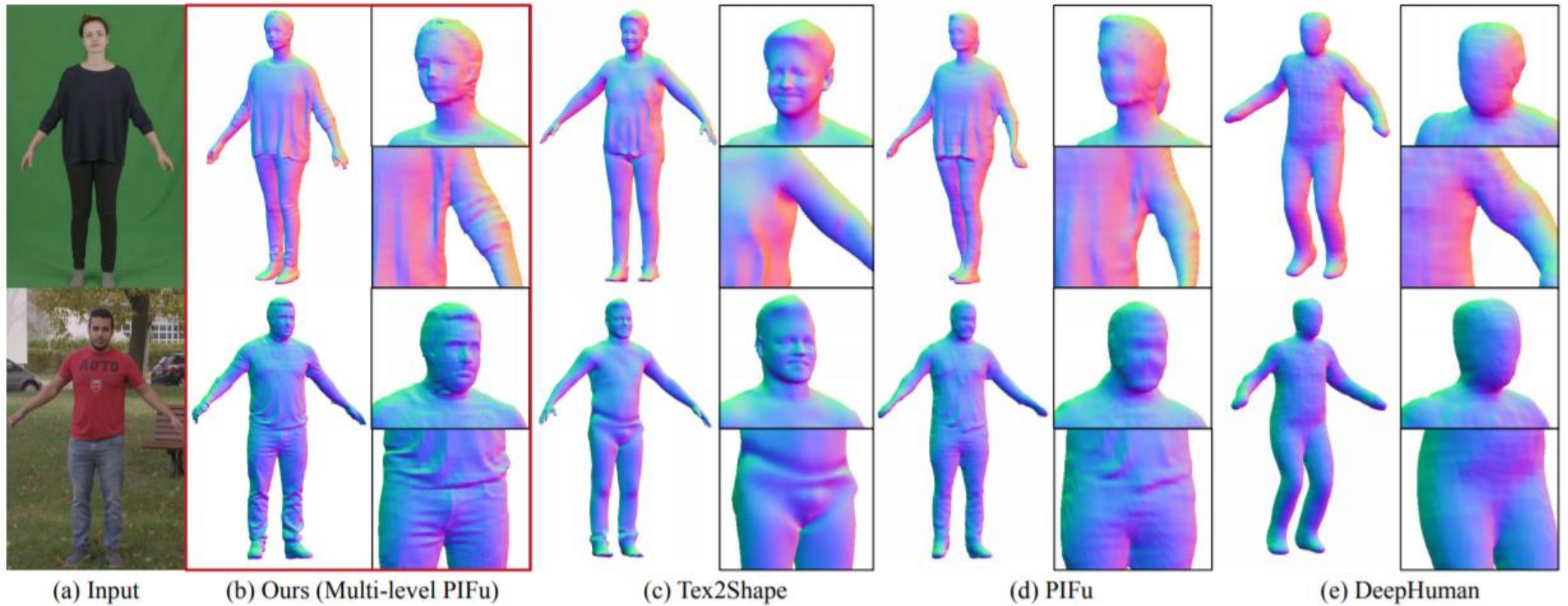
Methods



Results



Comparison with other Methods





Wish You Were Here: Context-Aware Human Generation

Gafni et al., CVPR, 2020.

Methods

Essence Generation Network



Multi-Conditioning Rendering
Network



Face Refinement Network

Methods



(a)



(b)



(c)

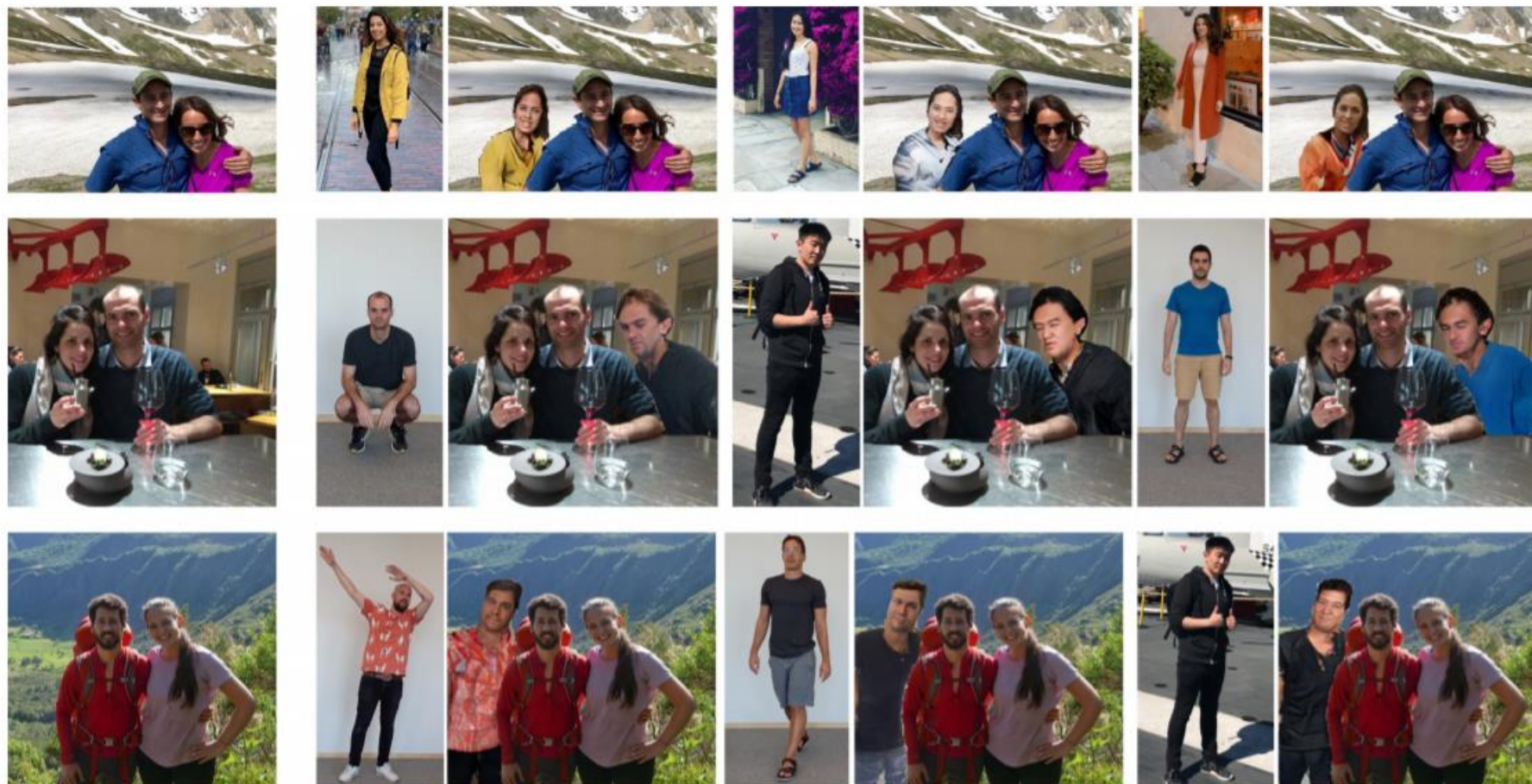


(d)



(e)

Result (Add person to source image)



Result (Replace with hair, shirt and pants)

Target



Hair



Shirt



Pants





Detectron2: A PyTorch-based modular object detection library

Facebook

DEMO Videos

- <https://ai.facebook.com/blog/-detectron2-a-pytorch-based-modular-object-detection-library-/>

Introduction

- Framework
 - Pytorch
- Modular, Extensible Design
- Models
 - Faster R-CNN, Mask R-CNN, RetinaNet, DensePose, Cascade R-CNN, Panoptic FPN, and TensorMask etc.
- Tasks: Object Detection with Box, Instance Segmantation Masks, Human Pose Prediction, Sematic Segmentation, Panoptic Segmentation

Semantic, Instance, Panoptic Segmentation

- Semantic Segmentation
 - Classify the objects into right Category
- Instance Segmentation
 - Segment each object separately
- Panoptic Segmentation
 - The combination of Semantic Segmentation and Instance Segmentation

Github Link

- <https://github.com/facebookresearch/detectron2>



Close-Proximity Flight of Sixteen Quadrotor Drones

CalTech



References

- Rethinking Weak Vs. Strong AI, Forbes.
- Detectron2: A PyTorch-based modular object detection library, Facebook Blog.
- Percy Liang and Dorsa Sadigh, CS221: Artificial Intelligence: Principles and Techniques, Stanford University.
- Introduction to Panoptic Segmentation: A Tutorial, Technical Fridays.