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CSCI 101

Connecting with Computer Science

Artificial Intelligence III



Jetic Gū
2020 Fall Semester (S3)

Overview

- Focus: Artificial Intelligence
- Readings: -
- Core Ideas:
 1. Limitations and Applications

Applications of AI

Different Areas of AI

- Computer Vision
 - Natural Language Processing
 - Signal Processing
 - Logical Reasoning
- Nothing is working here yet

Common Types of Tasks

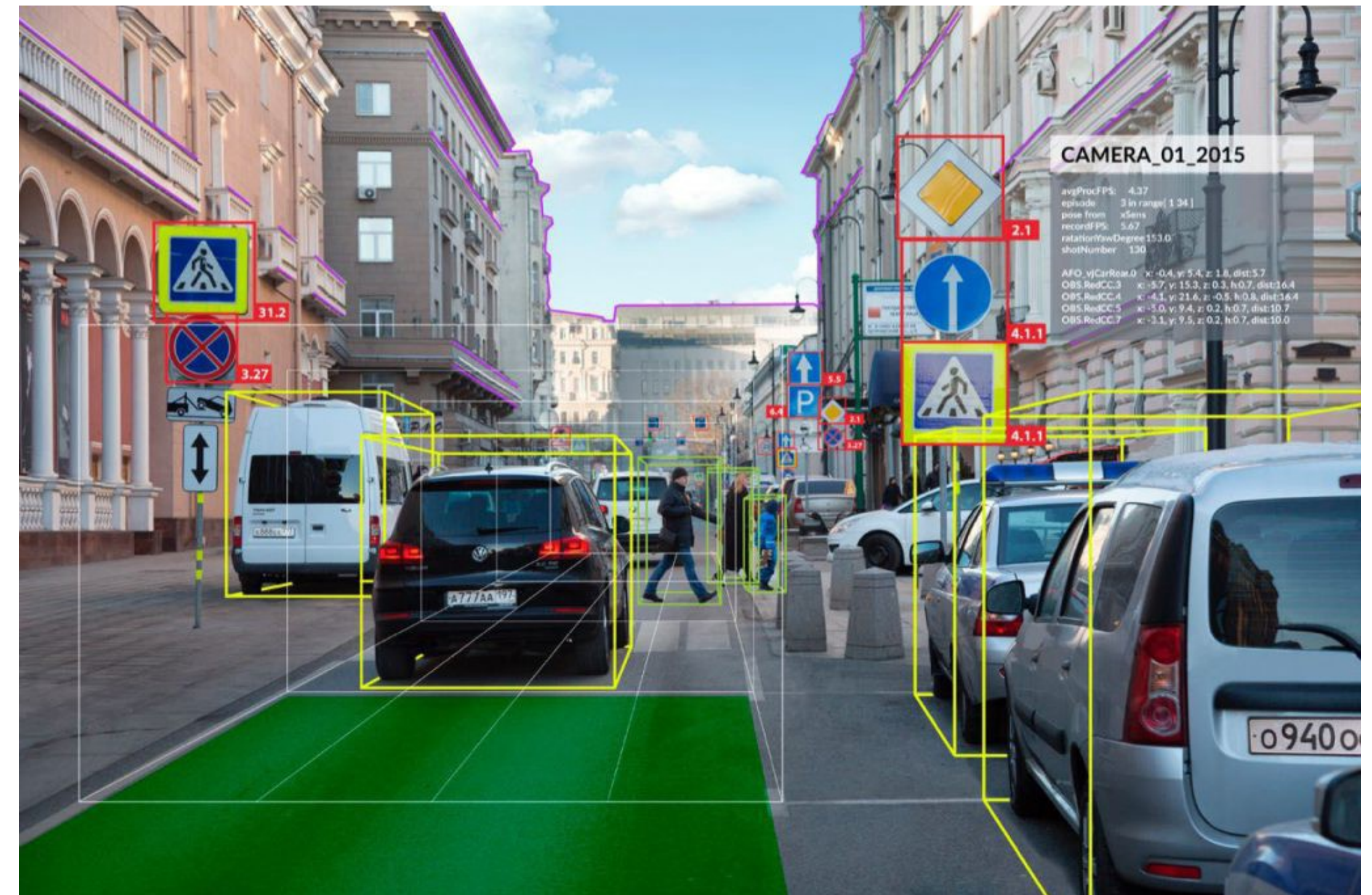
- Discriminative
 - Produce single predictions within predefined options
 - Image Classification, Text Classification
- Generative
 - Produce sequence of predictions
 - e.g. Image Generation, Text Generation

Computer Vision

- Processing Images
- Two major types of models
 - Image Classification
 - Given Image as input, generate prediction
 - Image Generation
 - Given any input, generate images

Computer Vision

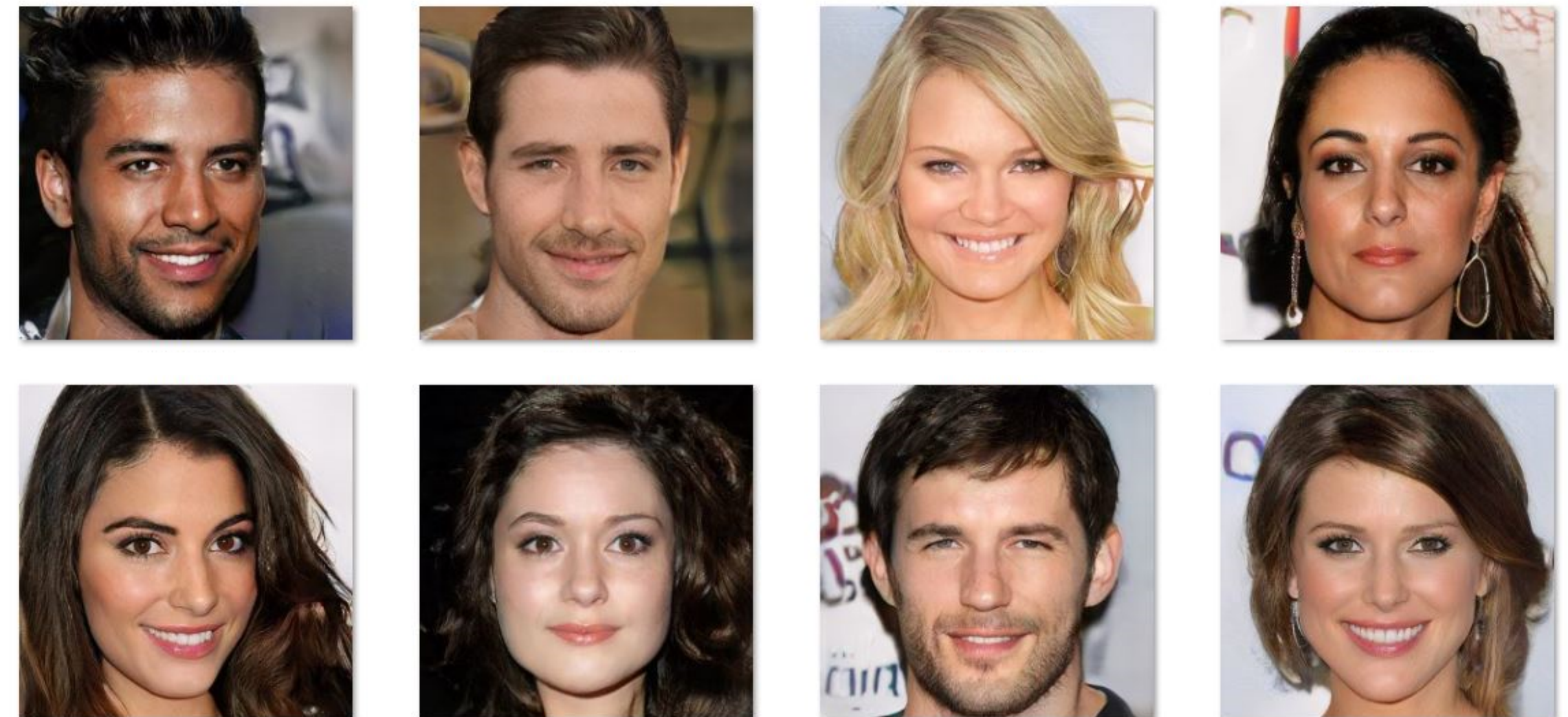
- Image Classification
- Recognising Handwritten Digits
- Autonomous Vehicles
- Object Identification
- Face Recognition
- etc.



Examples

Computer Vision

- Image Generation
 - Deep Fake¹
Input: videos, Output: replaced face
 - Generate Celebrity Faces²
 - Adobe Photoshop
 - etc.



1. Güera, David, and Edward J. Delp. "Deepfake video detection using recurrent neural networks." 2018 15th IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS). IEEE, 2018.

2. Radford, Alec, Luke Metz, and Soumith Chintala. "Unsupervised representation learning with deep convolutional generative adversarial networks." arXiv preprint arXiv:1511.06434 (2015).

Natural Language Processing

- Processing Human Text (in human language, or Natural Language)
- Two major types of models
 - Text Classification
 - Given text as input, generate prediction
 - Language Generation
 - Given any input, generate NL text

Natural Language Processing

- Text Classification
 - Syntax Analysis
 - Sentiment Analysis
 - Information Extraction
 - Fake News Detection
 - etc.

Natural Language Processing

- Language Generation
 - Machine Translation
 - ChatBot / Dialogue Agent
 - Document Summariser
 - Virtual Assistant
 - etc.

Signal Processing

- Processing any type of continuous signal
 - Most common task: voice recognition and separation
 - Speech synthesis

Natural Language Processing

- Text Classification
 - Syntax Analysis
 - Sentiment Analysis
 - Information Extraction
 - Fake News Detection
 - etc.

Natural Language Processing

- Language Generation
 - Machine Translation
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 - etc.

Limitations

- We've had a lot of advancement in NN research, with **better models than MLP**
- We've discovered a lot of useful applications of NN, such as **image processing** and **NLP**
- We've learn a lot about how to create NNs with more and more layers (**Deep Learning**)
- Problems
 - Learning algorithm: still **basic** back-propagation
 - Artificial neurones: **barely any progress** in the past 20 years
 - More layers of NN **does not improve performance** that much anymore
 - We are currently at the bottleneck!

Why is AI so hard?

- AI is all about designing algorithms to do what human can do
- **We do not know how human think, remember, and reason**
- Conventional AI models are based on simple mathematical models
 - Well, simple is a relative term
- Research is driven by profit

Questions?