Deep Learning

1. Introduction

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What is neural net?

Neural nets are special models for analyzing data.

- Images
- Sound
- Videos
- Text
- Numerical observations
- Sequences of actions

What neural nets are good for?

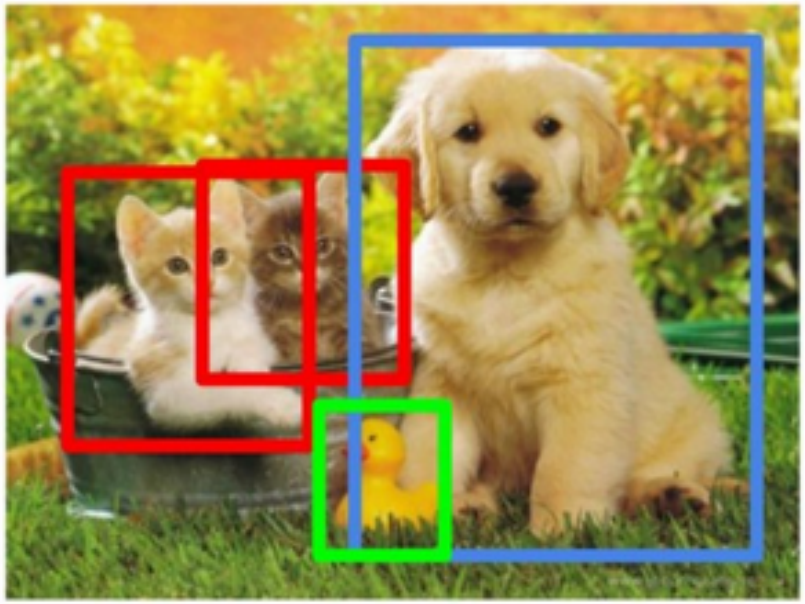
Near-human level image classification:

Classification

CAT

What neural nets are good for?

Object Detection



CAT, DOG, DUCK

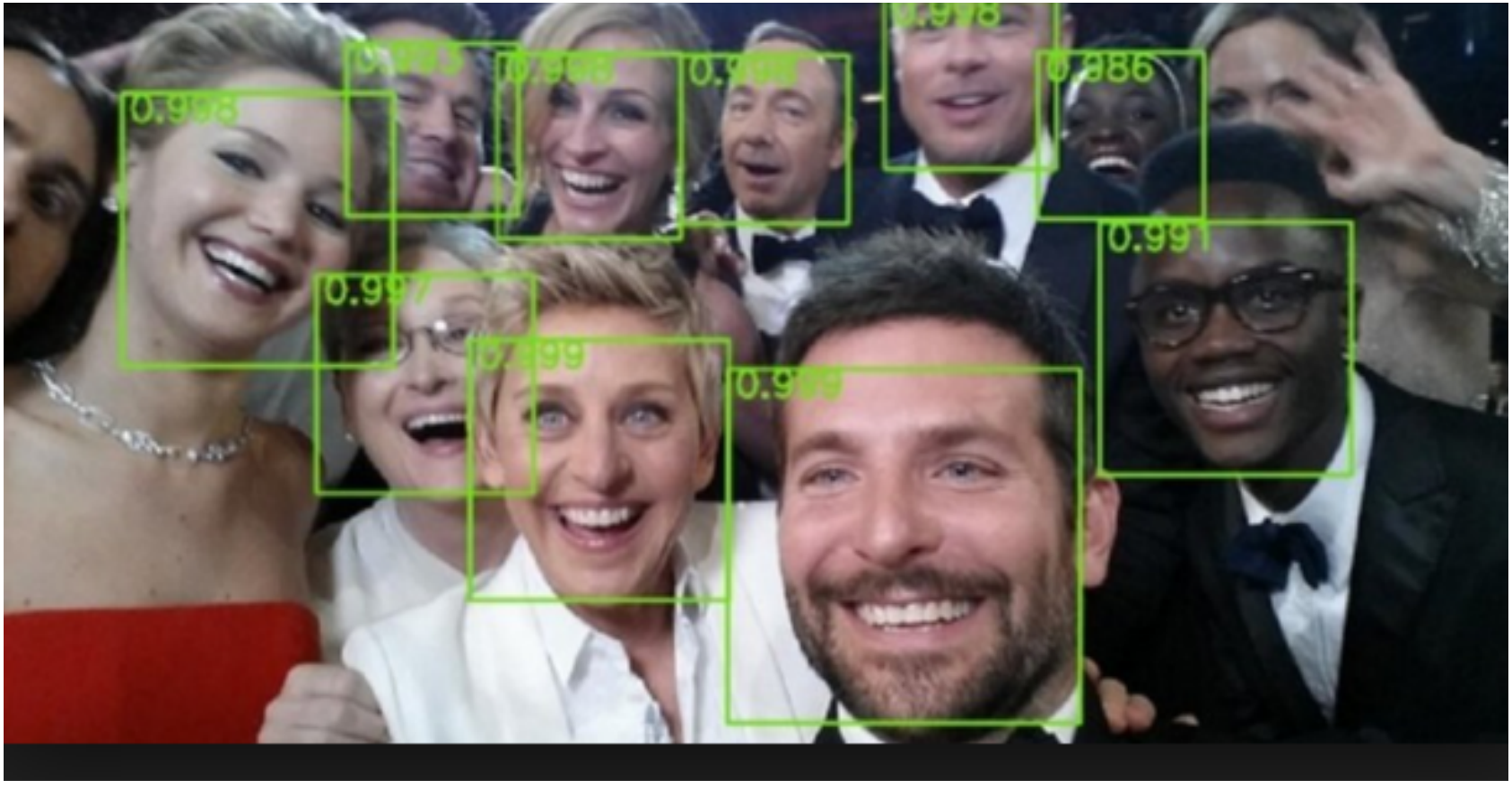
What neural nets are good for?

Instance Segmentation

CAT, DOG, DUCK

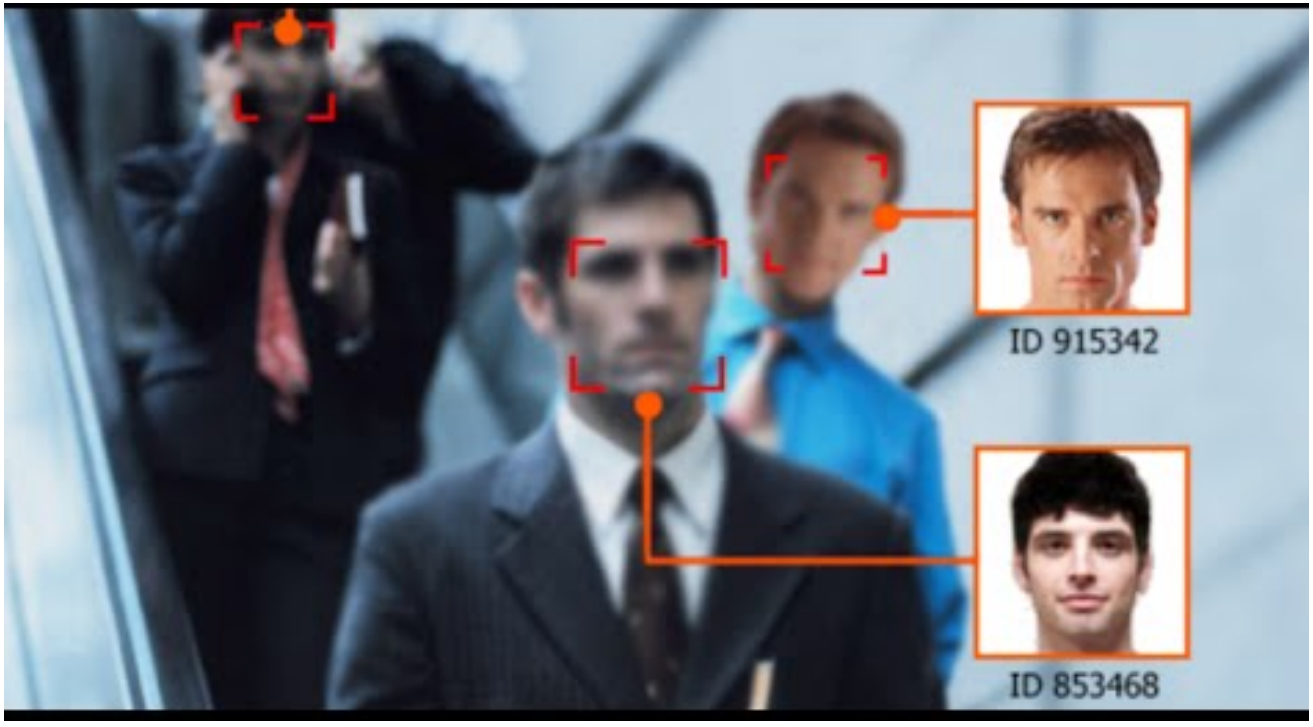
Real - world applications

Facebook: understands 350 m images uploaded per day by passing each of them through 3 conv nets.



Real - world applications

Face / action recognition on video streams



Real - world applications

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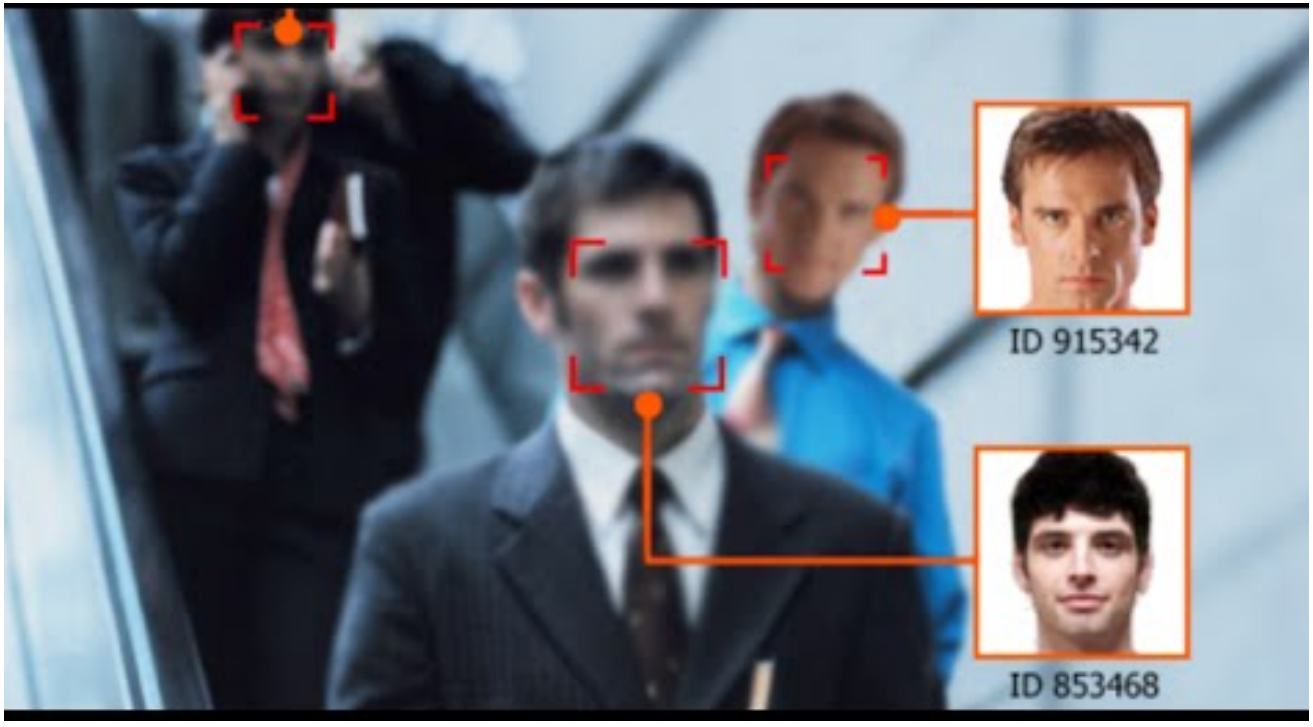


What neural nets are also good for?

- Near-human level speech recognition
- Improved machine translation: Google Neural Machine Translation

Generating images

Realistic face generation

Generating text

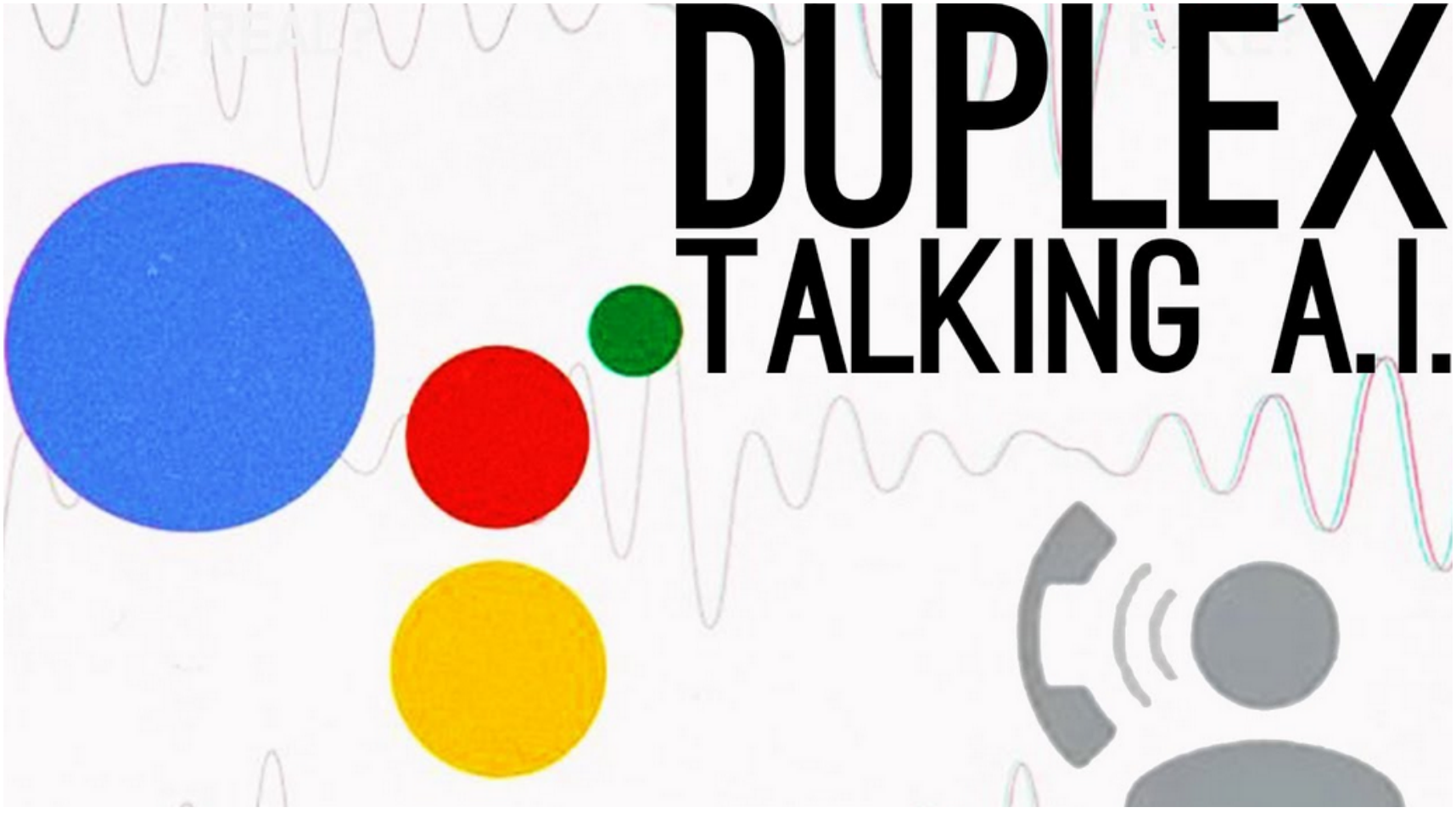
- Goal oriented chatbots: Siri, Alexa, Cortana

Complex systems 1

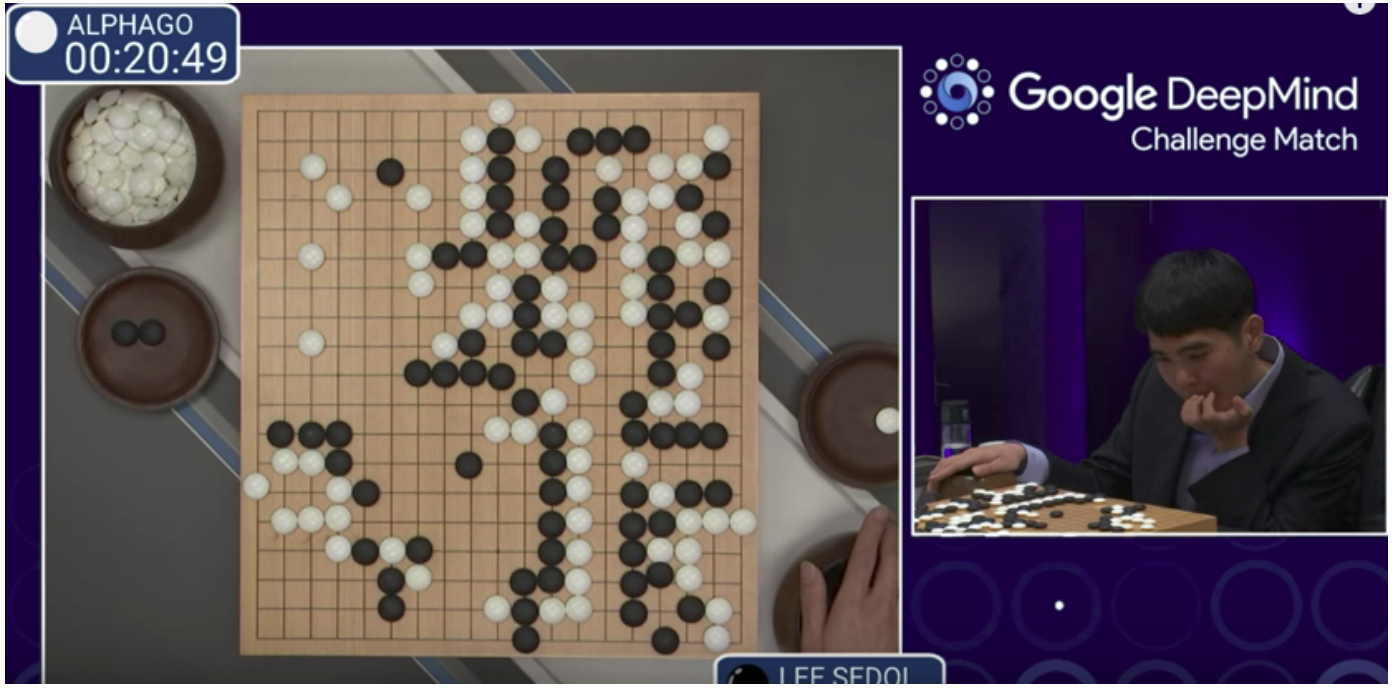
Near-human level autonomous driving.

Complex systems 2

Google Duplex



Mastering classical and video games



What deep learning still CANNOT do well?

- Generate long meaningful texts
- Quickly and efficiently learn
- Generalize well from single examples
- Simulate physical processes
- Write compicated code
- Prove theorems
- Infer physical laws

Advantages of deep learning?

- State of art models are published and open sourced
- Giant amount of online learning materials
- Open source libraries with implementations of main models
- Huge amount of available datasets
- Open for everyone

Disadvantages of deep learning?

- Models lack interperetability
- Neural networks can be fooled
- Theoretical properties are weakly studied
- A lot of data is needed to obtain high accuracy
- Huge computational resources are needed
- Other machine learning models are suppressed
- Deep learning possibilities are probably overestimated

Course overview

Lectures:

- Machine learning basic notions
- Linear models: linear, logistic regression
- Fully connected neural nets
- Convolutional neural nets
- Recurrent neural nets
- Unsupervised learning: from k-means to GANs and deep belief nets
- Reinforcement learning

Practice:

- Simple models with raw Python
- Complex models with Keras, Pytorch

That's all!

Thank you!