AI Applications

Modern applications of Artificial Intelligence

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School of AI - 2018

Artificial Neuron

Impulses carried toward cell body

dendrite

presynaptic terminal

axon

cell body

Impulses carried away from cell body

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x_0 w_0 synapse

axon from a neuron

$w_0 x_0$

dendrite

cell body

$w_1 x_1$

$$\sum_i w_i x_i + b \quad f$$

$$f\left(\sum_i w_i x_i + b\right)$$

output axon

activation function

$w_2 x_2$
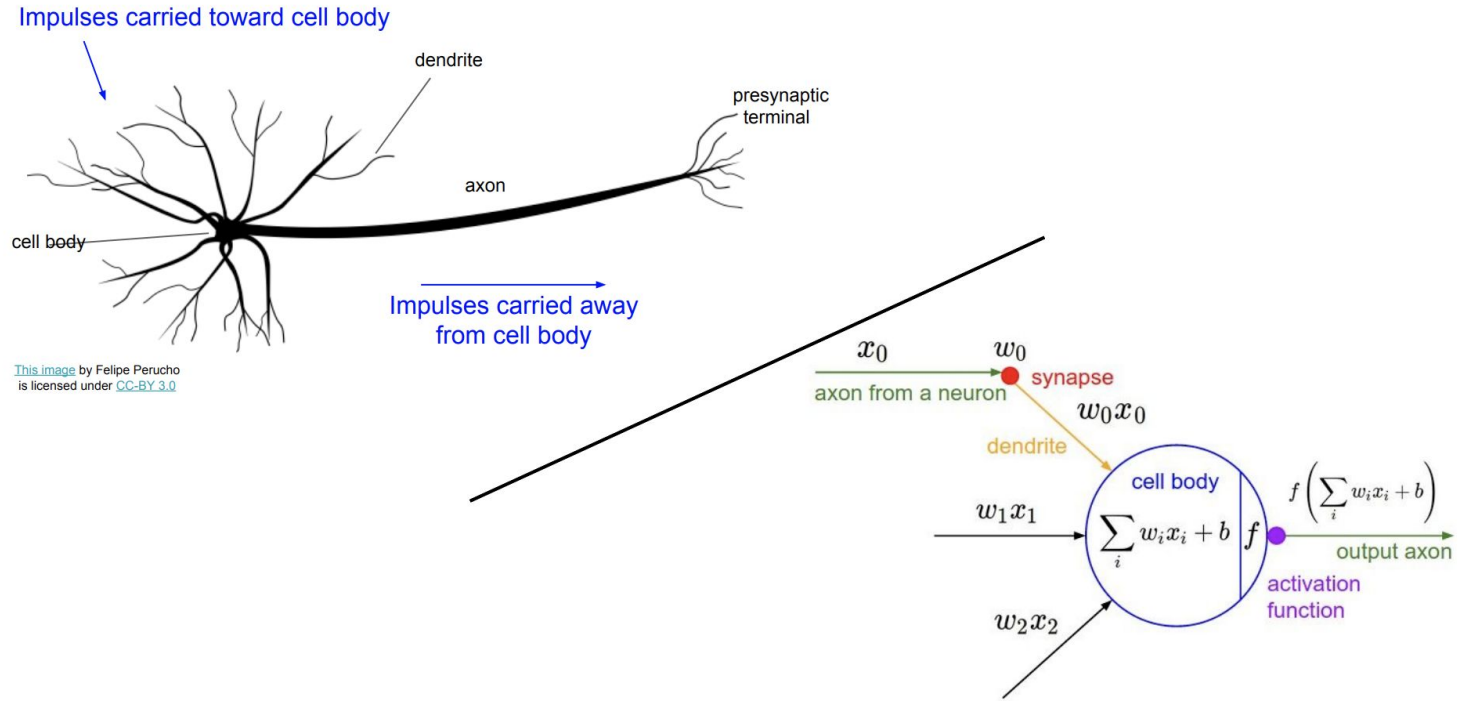
Artificial Neural Network - Deep Learning

DEEP NEURAL NETWORK

Input layer → Hidden layer 1 → Hidden layer 2 → Hidden layer 3 → Output layer

neuralnetworksanddeeplearning.com - Michael Nielsen, Yoshua Bengio, Ian Goodfellow, and Aaron Courville, 2016.
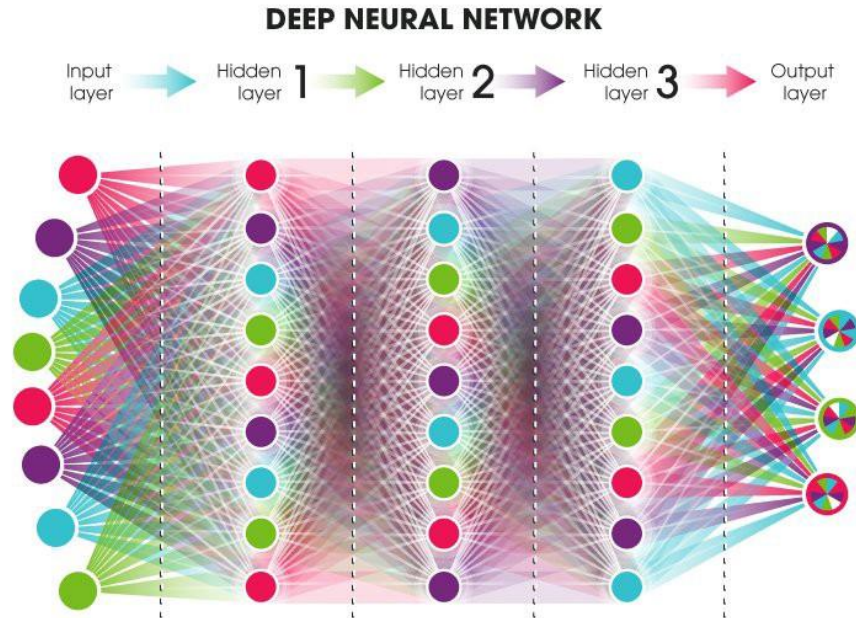
Automatic Image Tagging
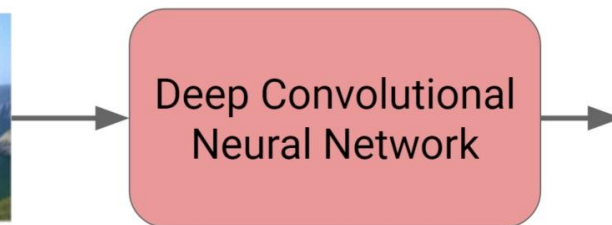
Speech to Text

Speech Recognition

Acoustic Input → Deep Recurrent Neural Network → Text Output "How cold is it outside?"
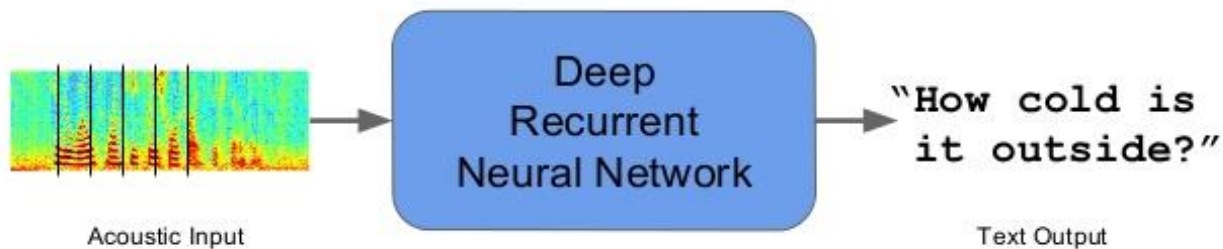
Reduced word errors by more than 30%

Google Research Blog - August 2012, August 2015

Research at Google

Page Ranking

RankBrain in Google Search Ranking

Query: "car parts for sale",
Doc: "Rebuilt transmissions ..."

Query & document features

→ Deep Neural Network →

Score for doc,query pair
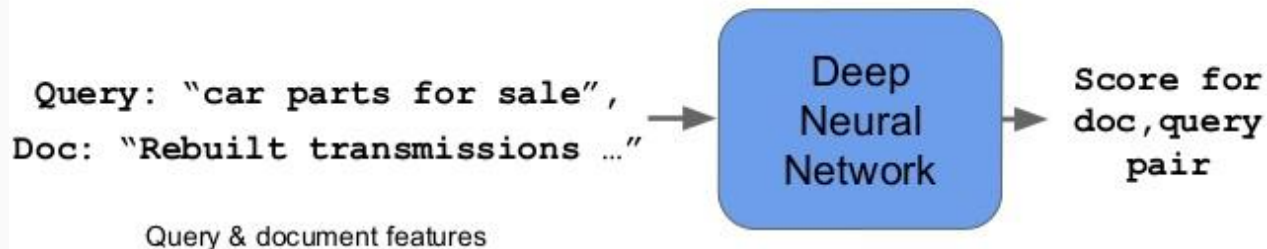
Launched in 2015
Third most important search ranking signal (of 100s)

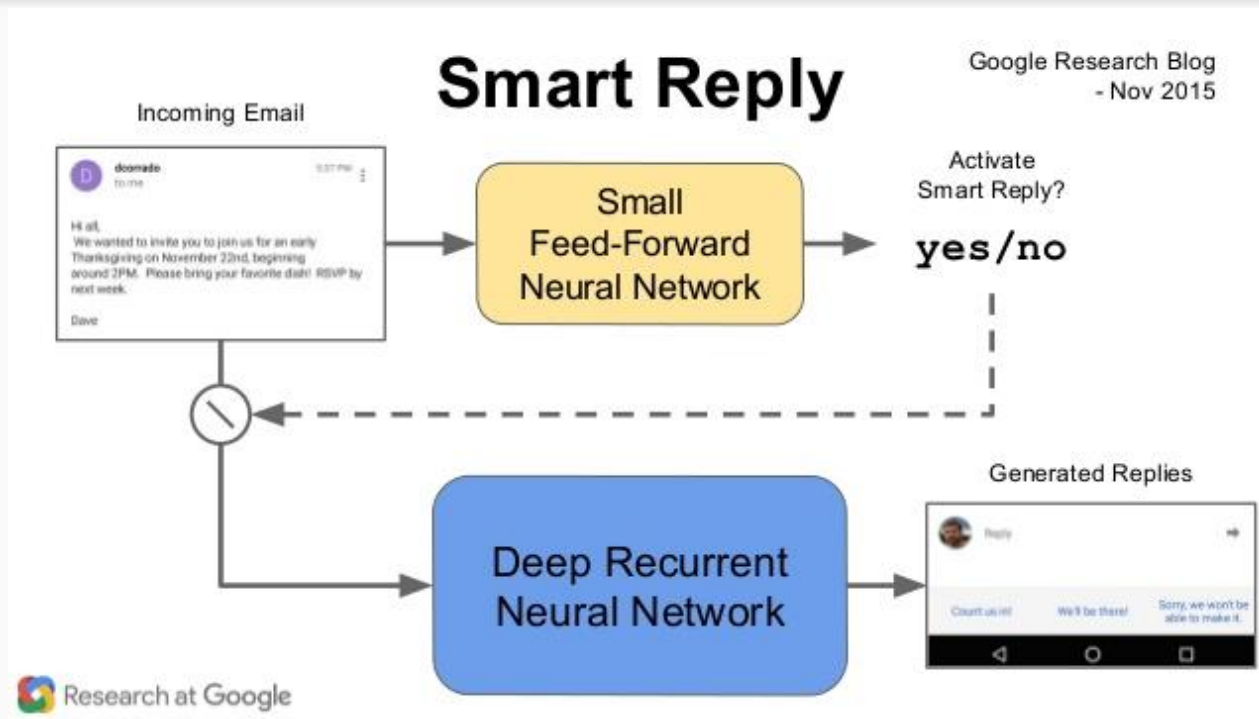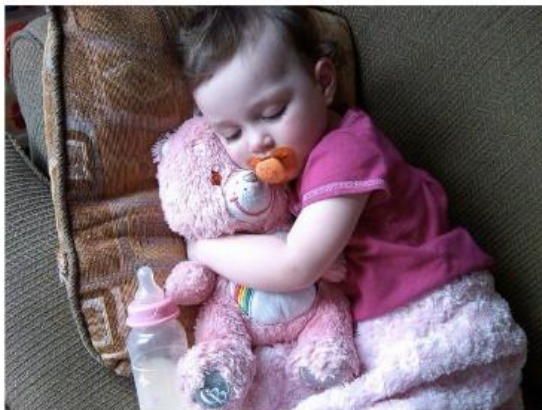Bloomberg, Oct 2015: "*Google Turning Its Lucrative Web Search Over to AI Machines*"

Research at Google

Auto Reply

Image Captioning

Generating Image Captions from Pixels

Human: A young girl asleep on the sofa cuddling a stuffed bear.
Model sample 1: A close up of a child holding a stuffed animal.
Model sample 2: A baby is asleep next to a teddy bear.

Google

Work in progress by Oriol Vinyals *et al.*

Estimate solar savings potential

✓ Analysis complete. Your roof has:

☀ **1,531 hours of usable sunlight per year**
Based on day-to-day analysis of weather patterns

⌂ **758 sq feet available for solar panels**
Based on 3D modeling of your roof and nearby trees

$5,000 savings
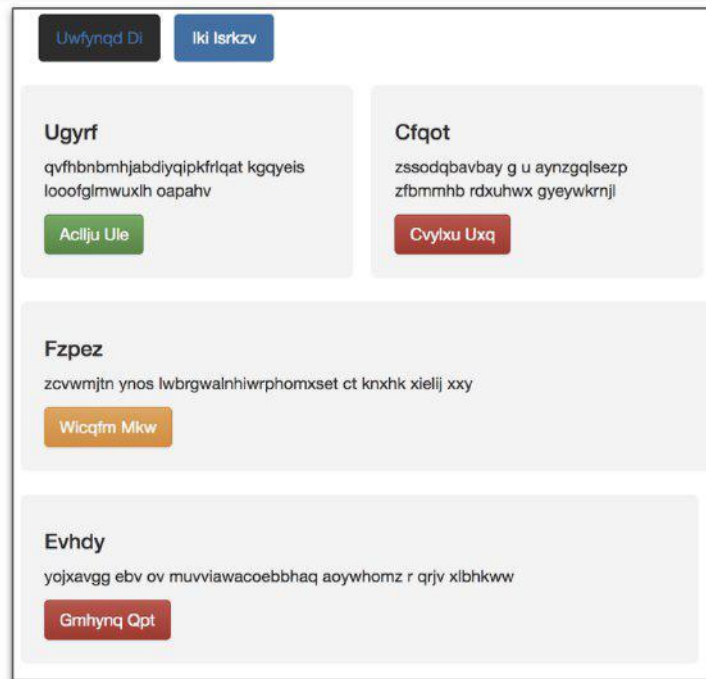Estimated net savings for your roof with a 20-year lease

FINE-TUNE ESTIMATE   SEE SOLAR PROVIDERS

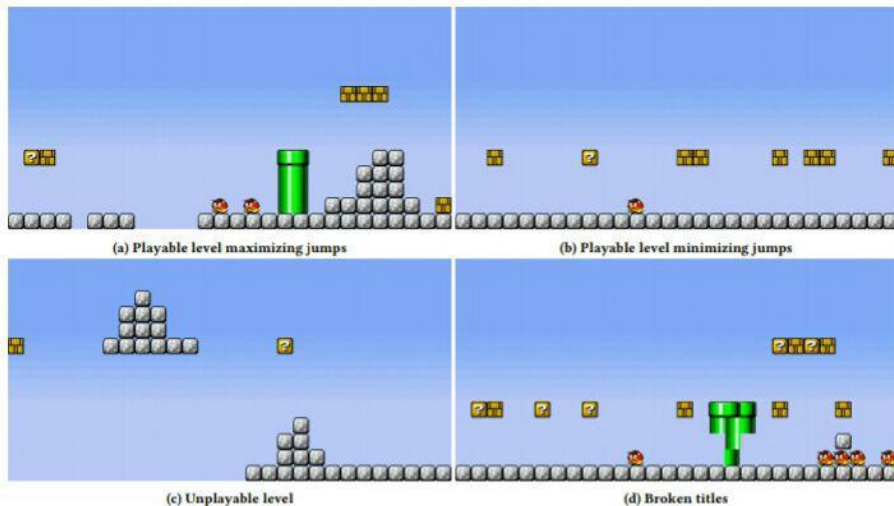Wrong roof? Drag the marker to the right one.

Front-end Development

Self-driving Cars
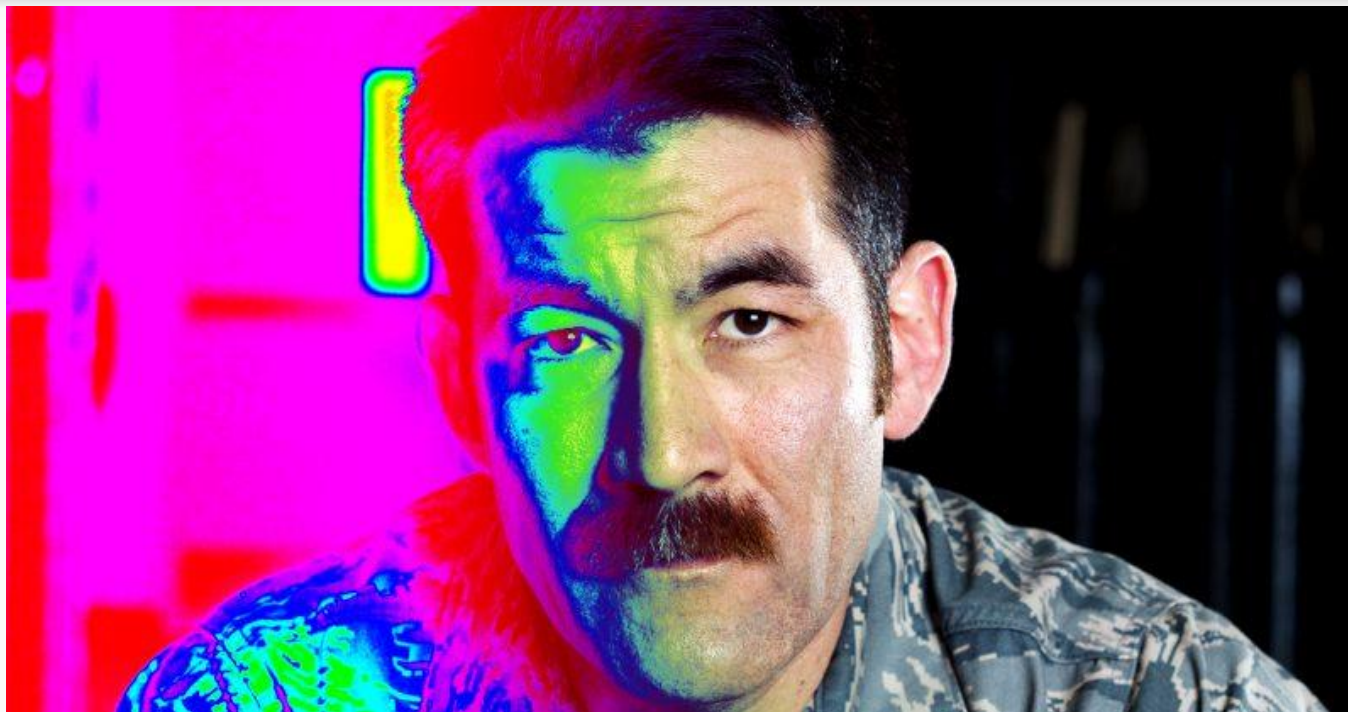
Generate New Game Levels

Figure 6: Level with increasing difficulty. Our LVE approach can create levels composed of multiple parts that gradually increase in difficulty (less ground tiles, more enemies). In the future this approach could be used to create a level in real-time that is tailored to the particular skill of the player (dynamic difficulty adaptation).

(a) Playable level maximizing jumps

(b) Playable level minimizing jumps

(c) Unplayable level

(d) Broken titles

RF-Pose

Recognize faces in the dark and through walls

Deep Painterly Harmonization

Style Transfer

1 Upload photo

The first picture defines the scene you would like to have painted.

2 Choose style

Choose among predefined styles or upload your own style image.

3 Submit

Our servers paint the image for you. You get an email when it's done.
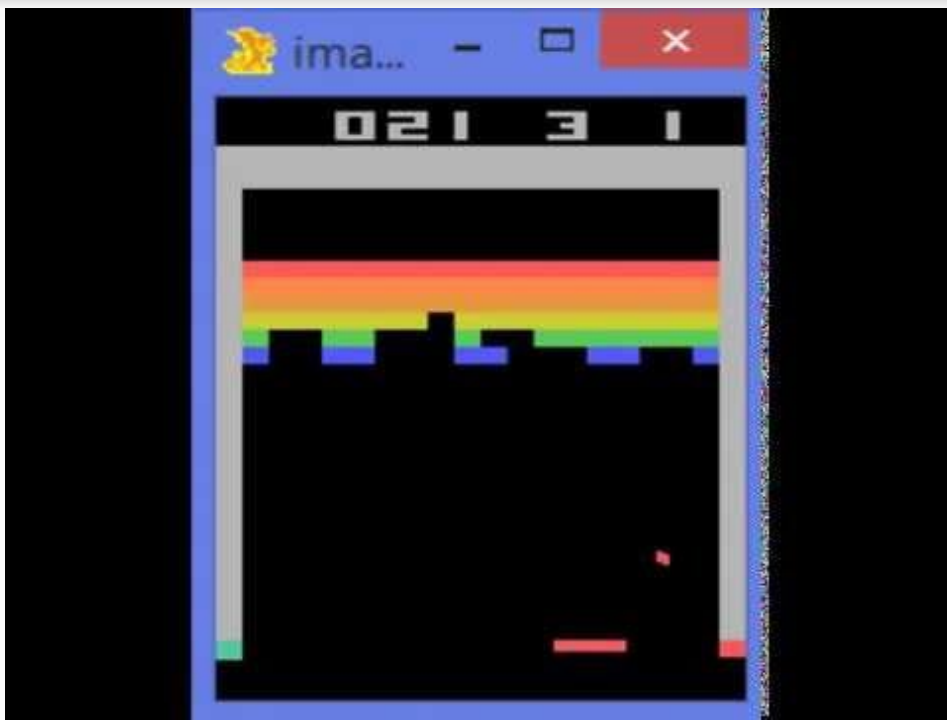
Style Transfer

Deep Style

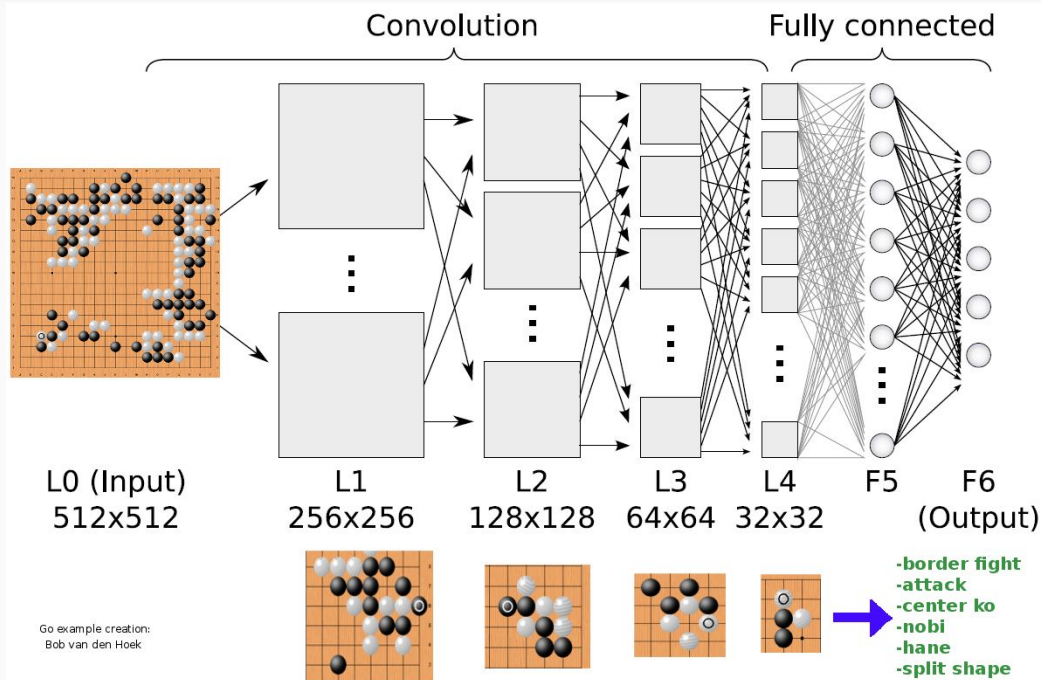# Personalized Fashion Design

Play ATARI Games

Play Board Games
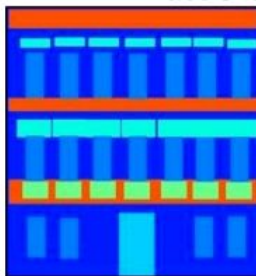
Convolution — Fully connected

L0 (Input) 512x512 L1 256x256 L2 128x128 L3 64x64 L4 32x32 F5 F6 (Output)

Go example creation: Bob van den Hoek

- border fight
- attack
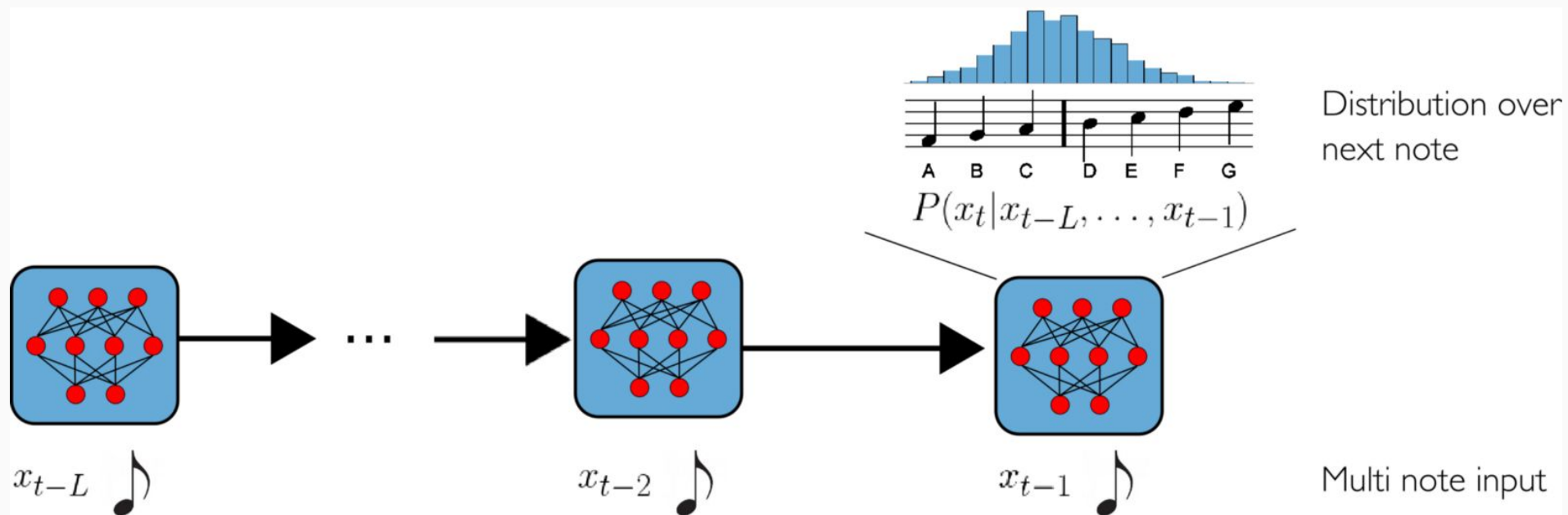- center ko
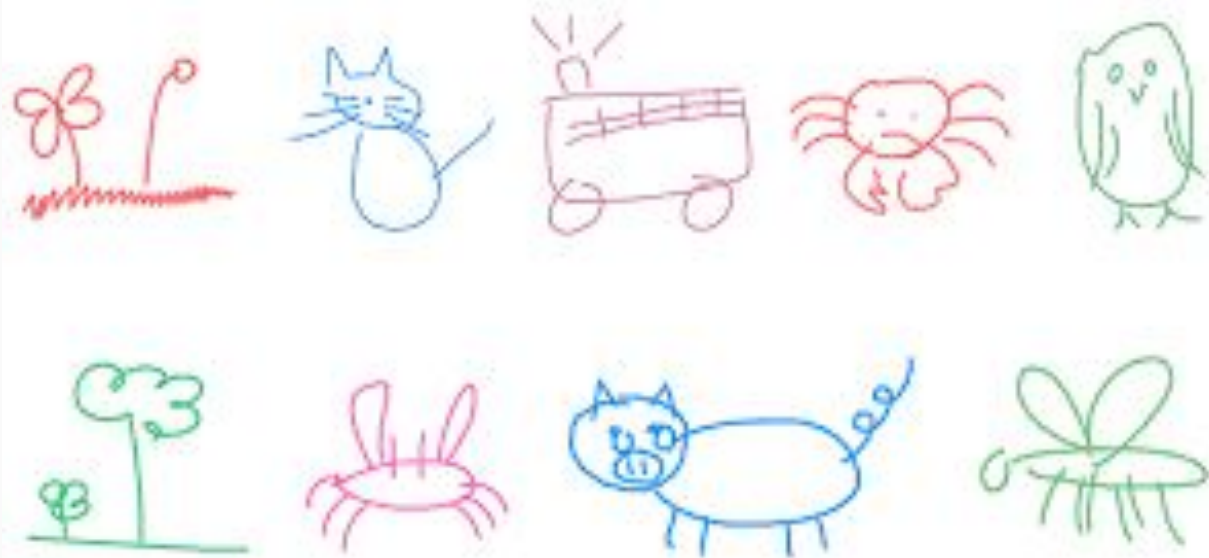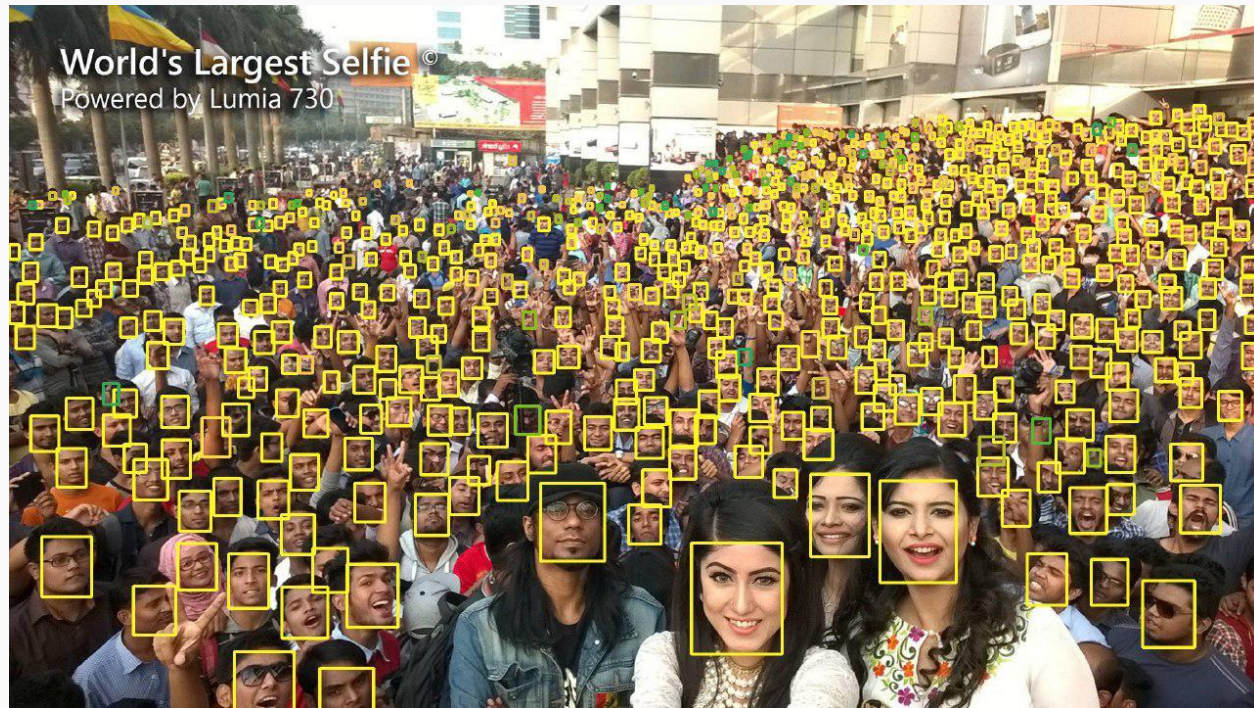- nobi
- hane
- split shape

Image Generation

Music Generation

Drawing

Finding Tiny Faces

Google Duplex
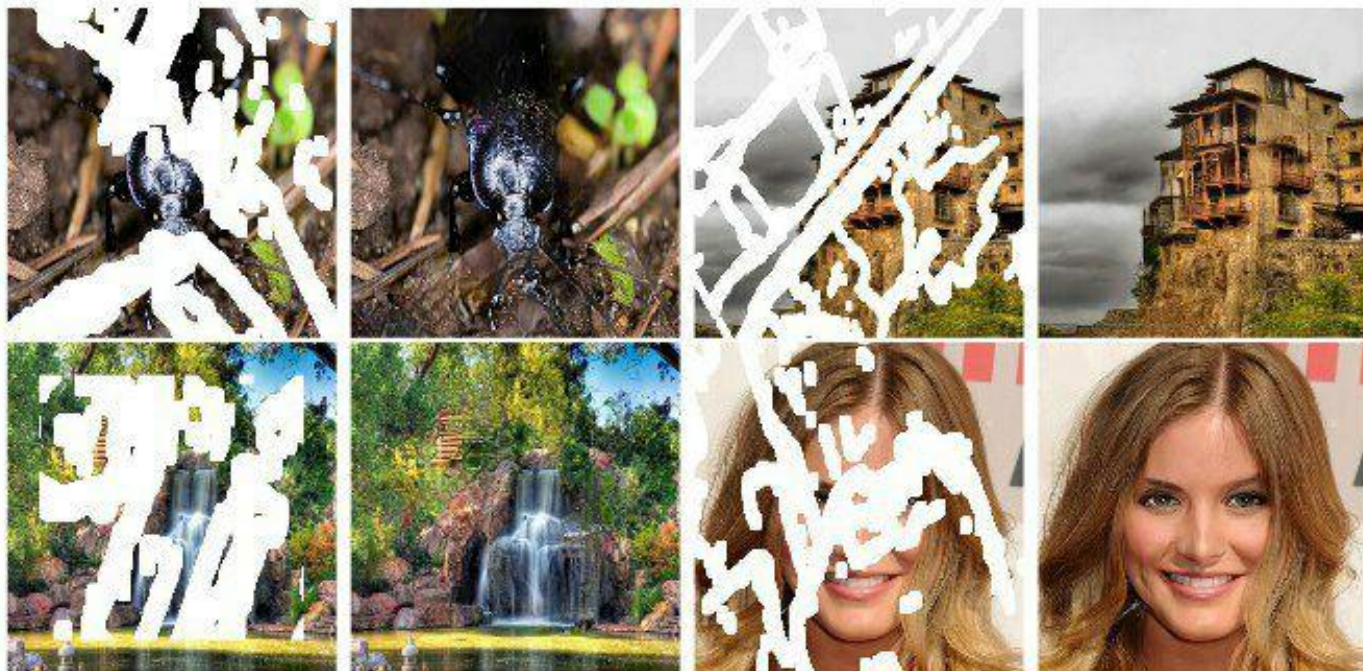
Image Inpainting

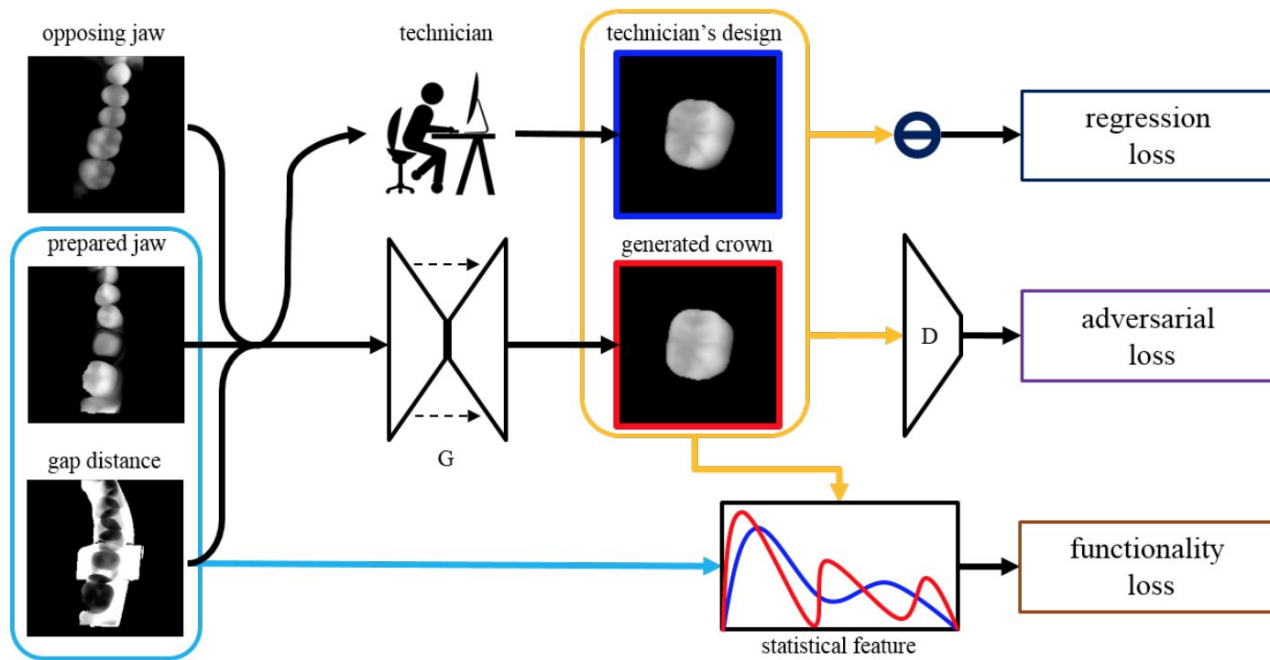# Image Outpainting

INPUT → OUTPUT

Eye-opener

Raindrop Removal from a Single Image

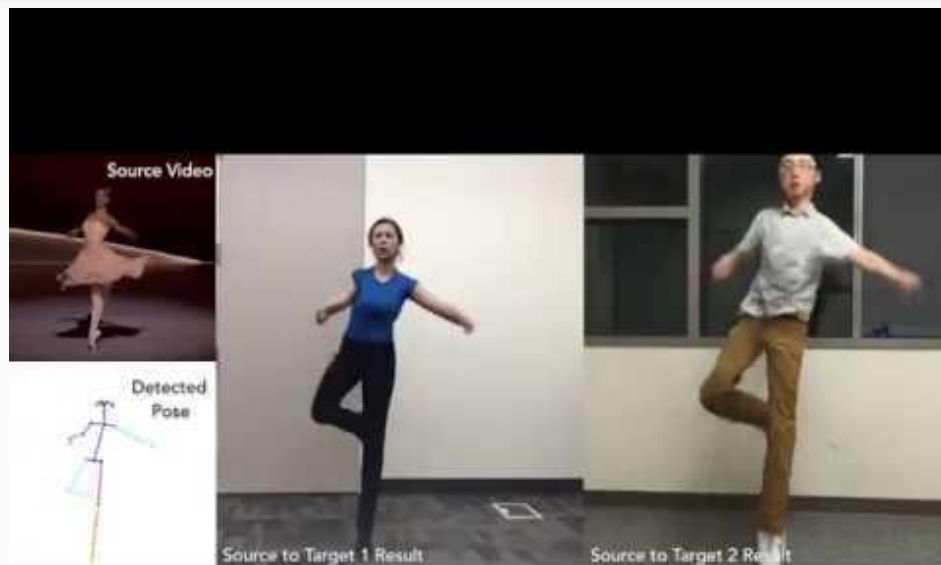# Design Dental Crowns

Learning Lip Sync from Audio

Move Mirror

Everybody dance now!

Play Dota 2

Thank You!