UNIVERSITY OF EASTERN FINLAND

Tekoälyn, konenäön ja hahmontunnistuksen uudet virtaukset ja sovellukset

Teollisuus X.0 –Tuotannon ja toimitusketjun digitalisointi

Professori Pekka Toivanen

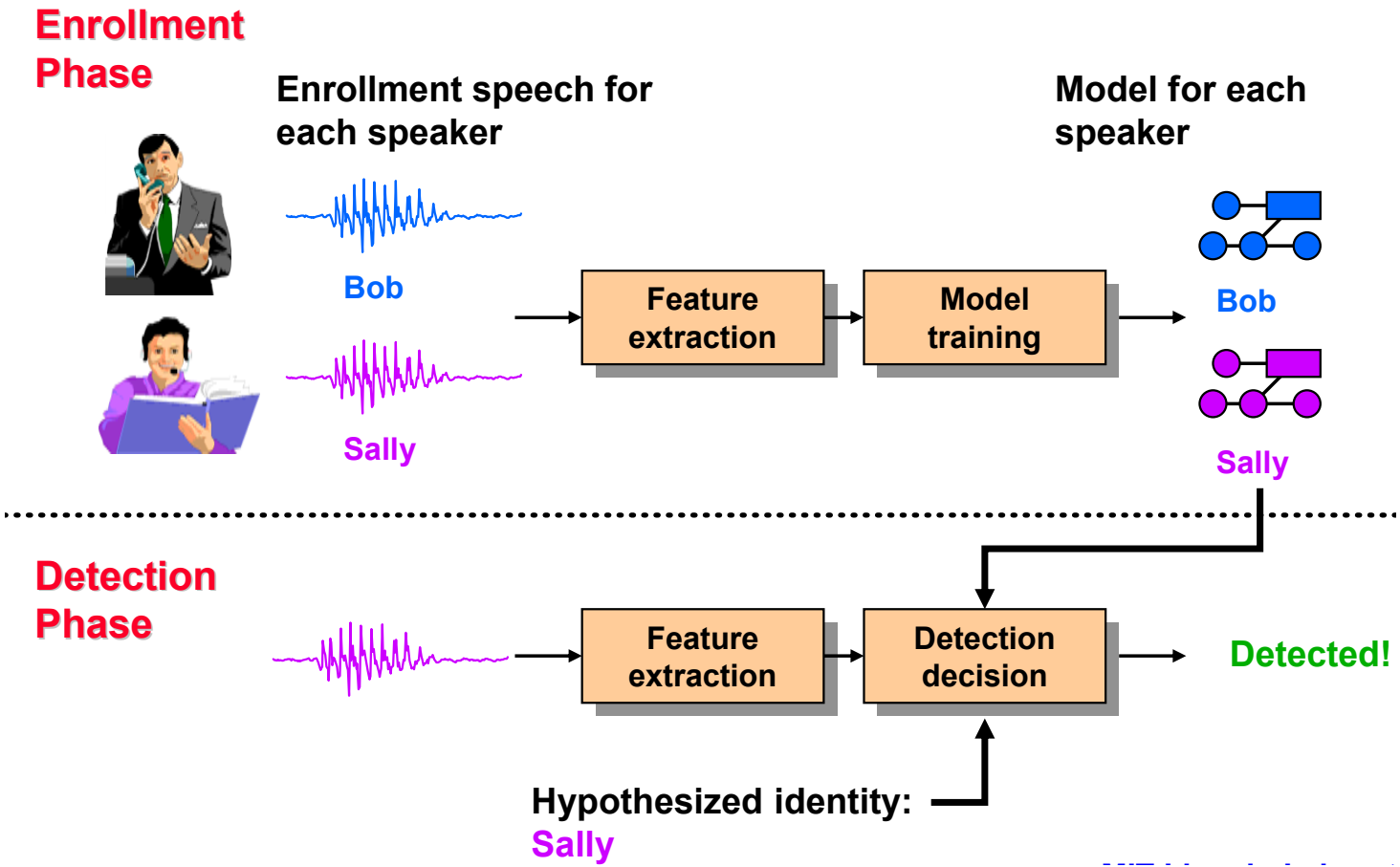
UEF // University of Eastern Finland

Euroopan unioni
Euroopan sosiaalirahasto

Vipuvoimaa EU:lta 2014–2020

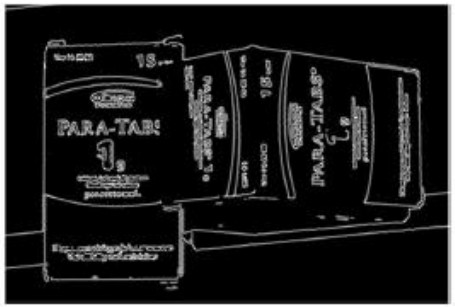
Elinkeino-, liikenne- ja ympäristökeskus

Two phases to speaker detection



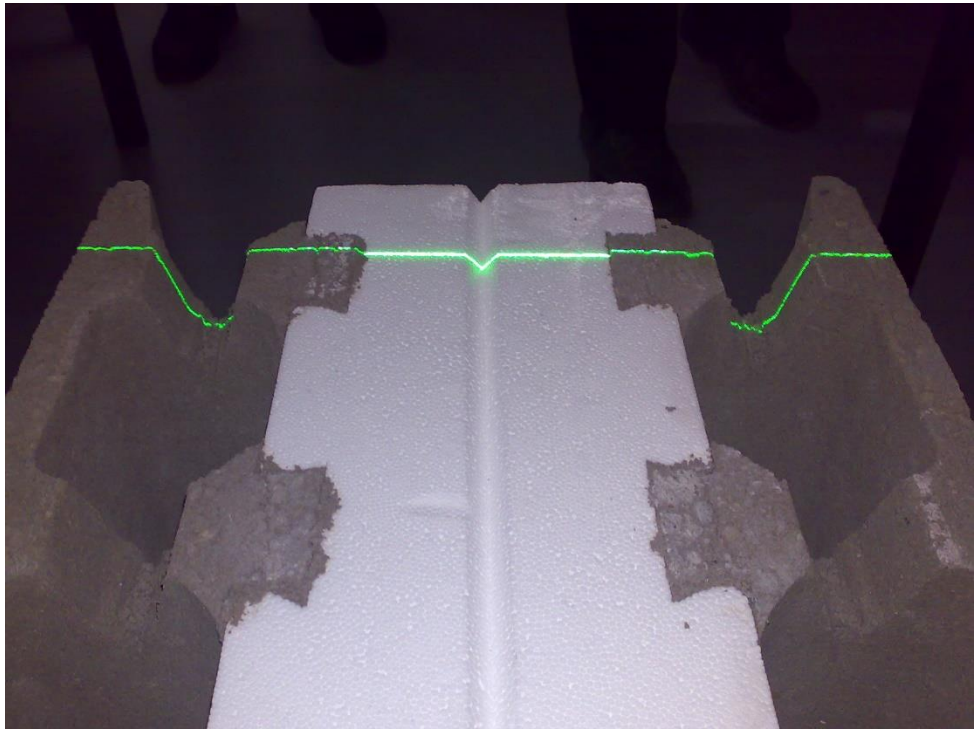
Vaalealla taustalla kuvatut paketit:

Osittain ja kokonaan vierekkäin olevat paketit: Voidaan

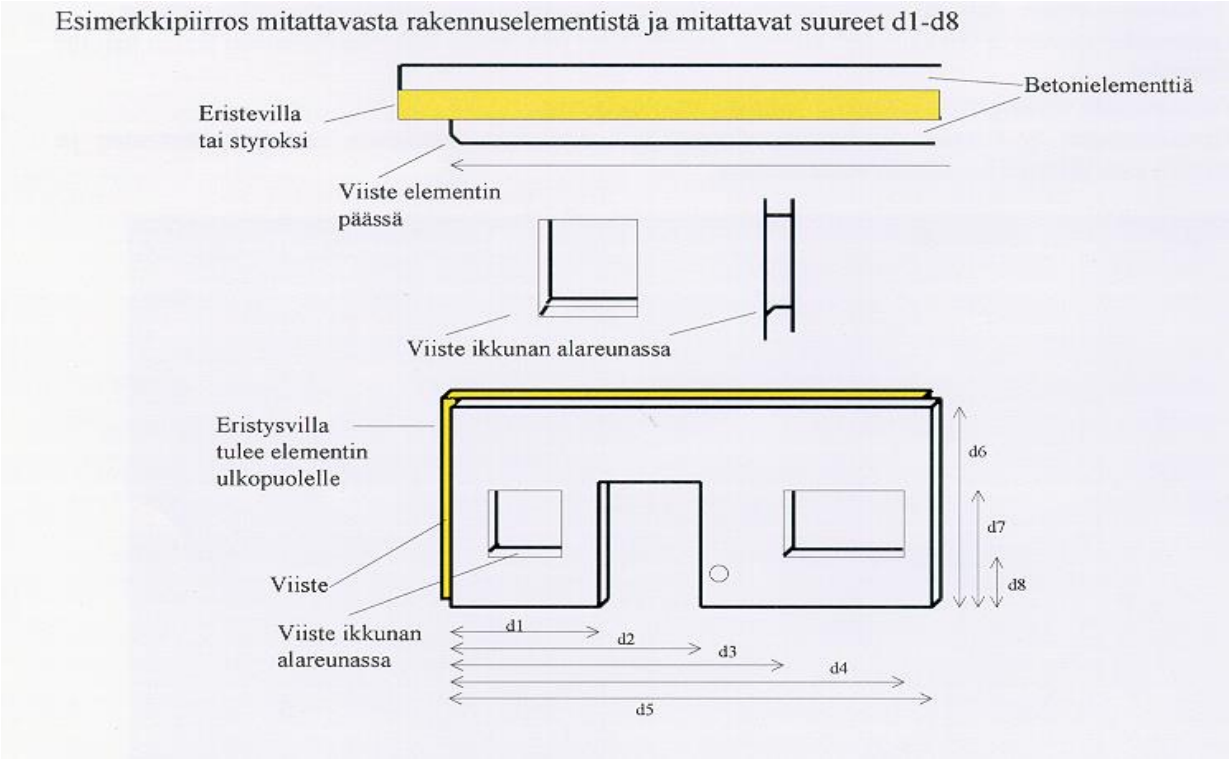


Osittain päällekkäin olevat paketit: Ei voida

Rakennusharkon dimensioiden mittaus

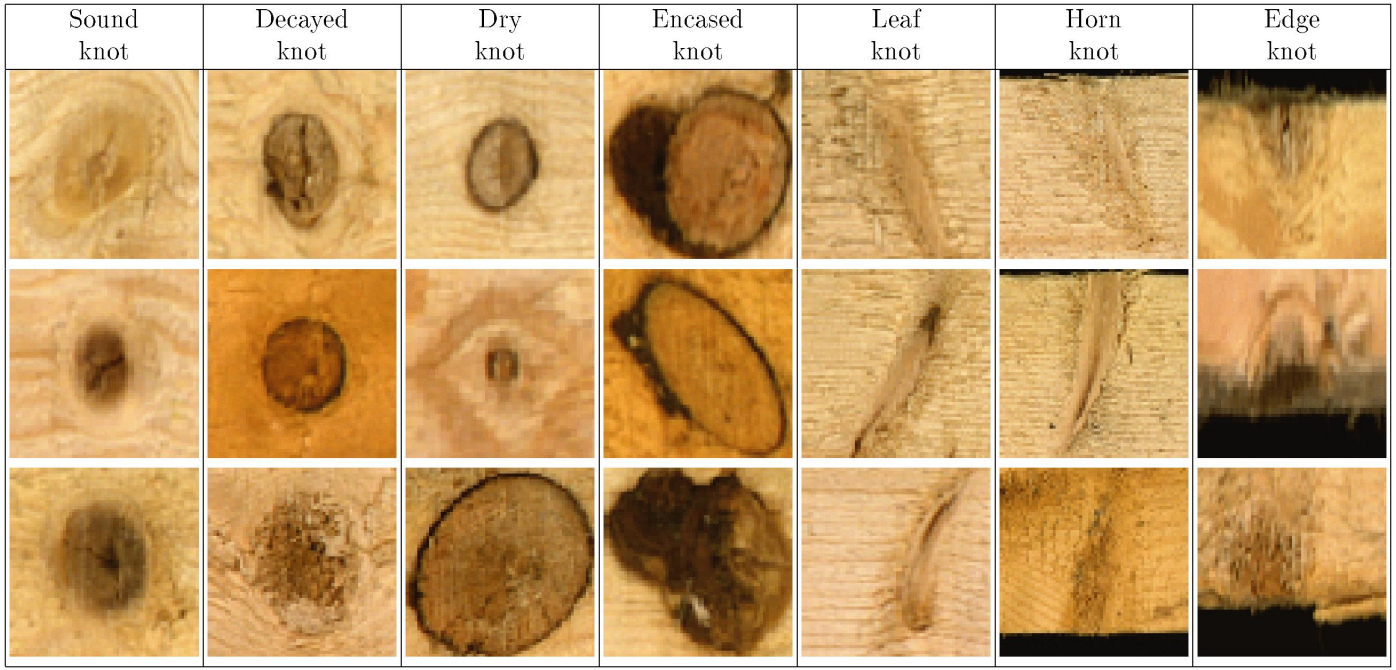


Rakennuselementtien dimensioiden automaattinen mittaaminen



Lautojen automaattinen lajittelu oksanreikien avulla

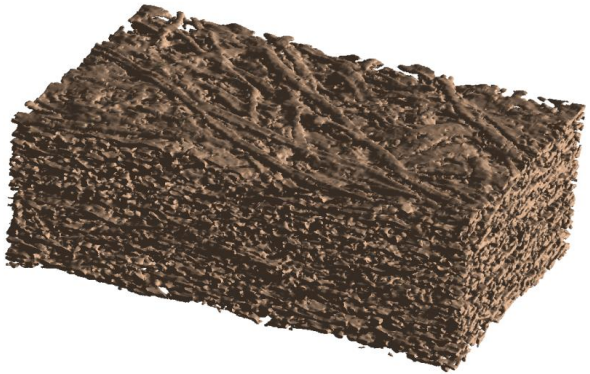
- Oksanreikätyyppinen mallintaminen mahdotonta



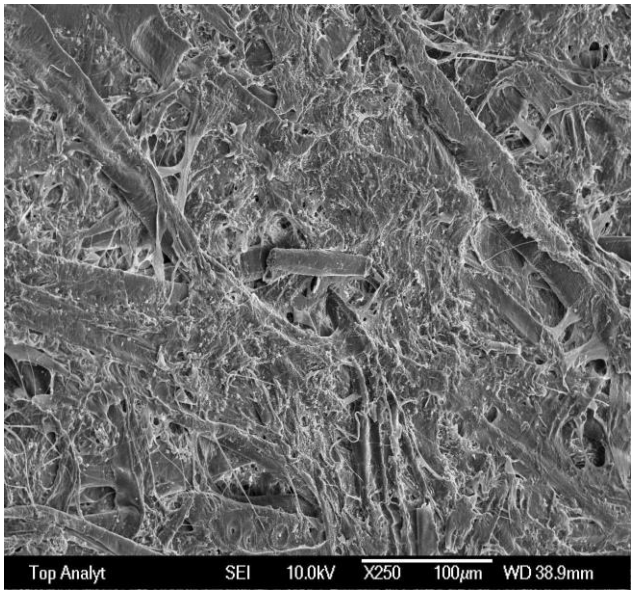
Puutukkien tilavuusvirran automaattinen mittaaminen

Paperin karheuden automaattinen mittaaminen konenäön avulla

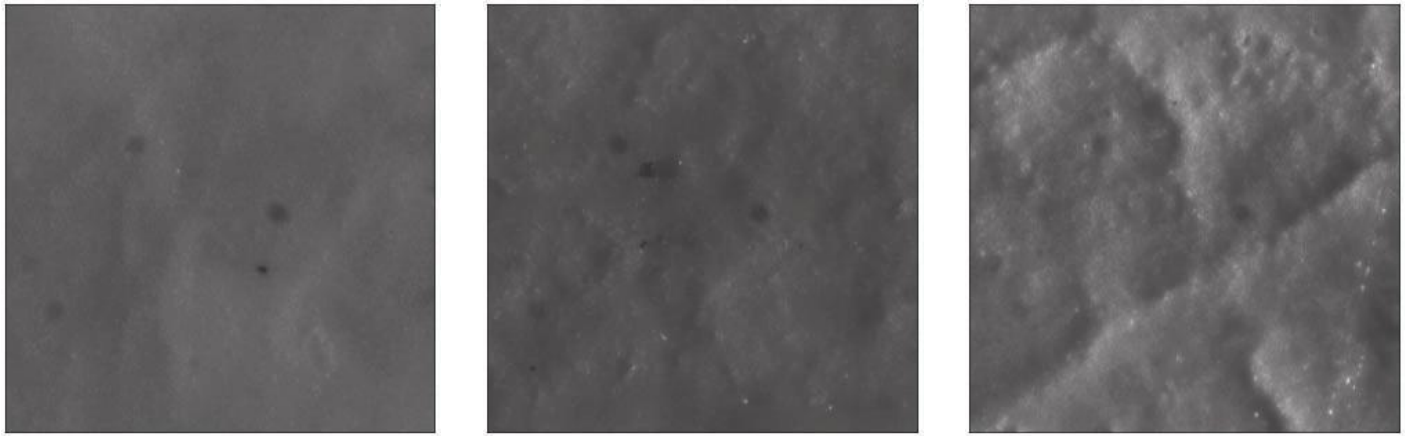
- **On-line mittaaminen paperikoneella**
- **Off-line mittaaminen laboratoriossa**



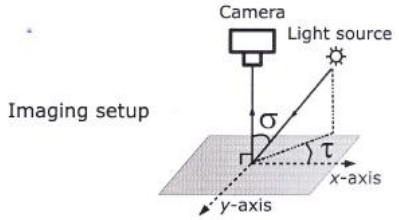
STORA ENSO RESEARCH



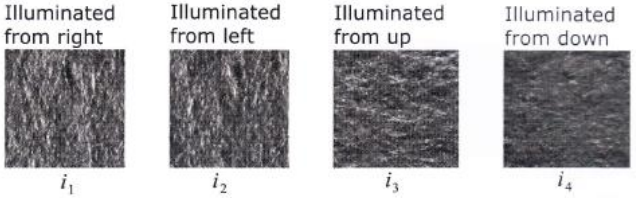
Paperin karheuden mittaaminen konenäön avulla



Kolme eri karheustasoa edustavaa LWC-paperinäytettä.



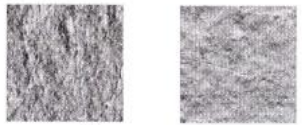
Acquired images



$$p=\frac{\partial f}{\partial x}=\frac{2}{\tan\sigma}\frac{i_1-i_2}{i_1+i_2+i_3+i_4}$$

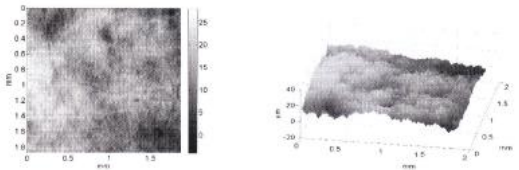
Gradient field estimation

$$q=\frac{\partial f}{\partial y}=\frac{2}{\tan\sigma}\frac{i_3-i_4}{i_1+i_2+i_3+i_4}$$

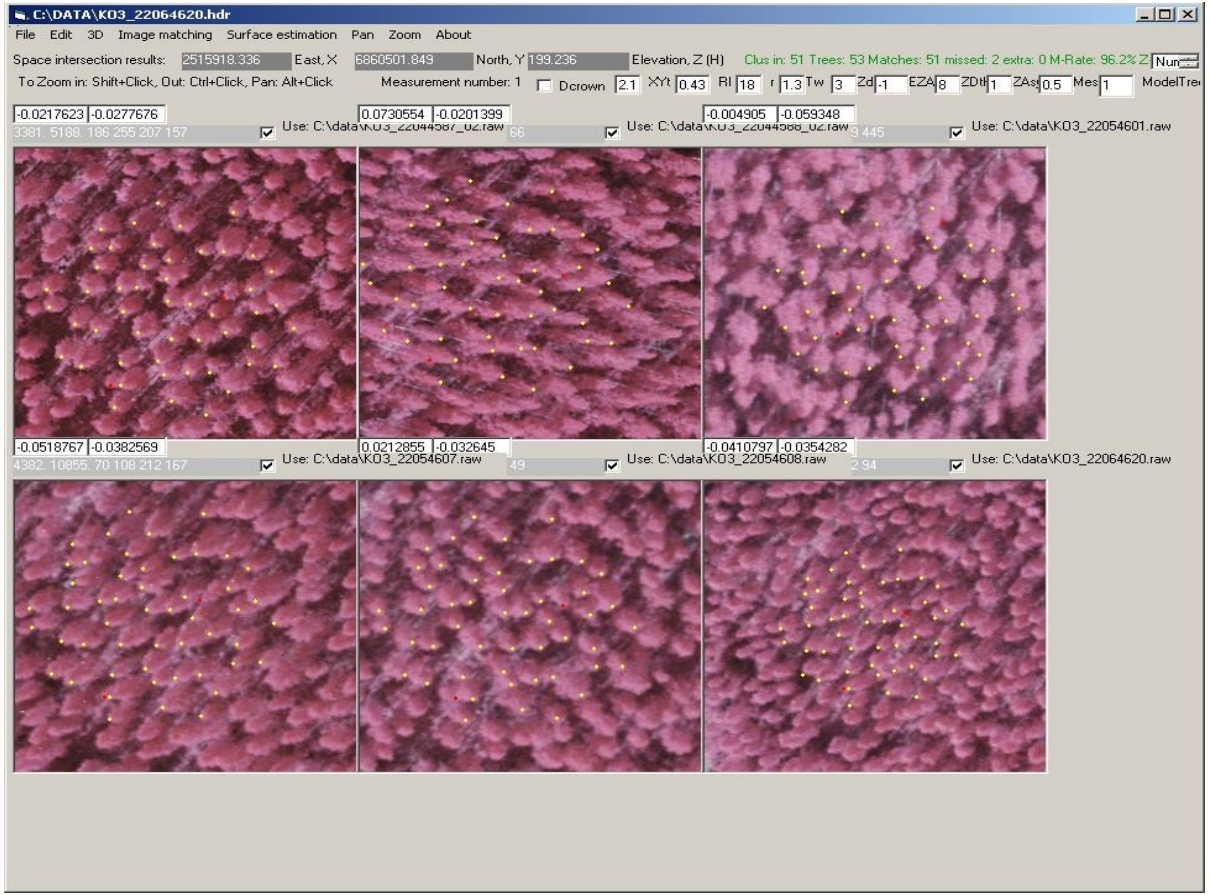


Integration

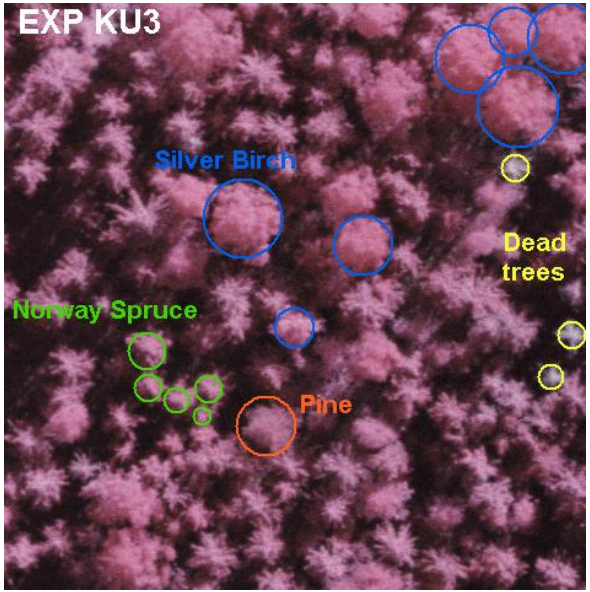
Reconstructed surface

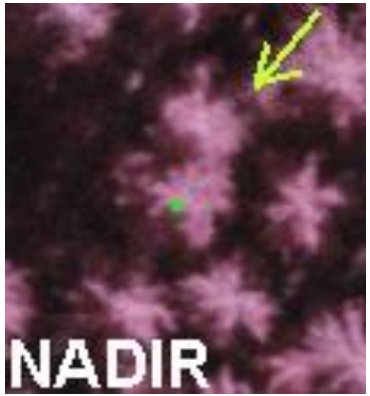


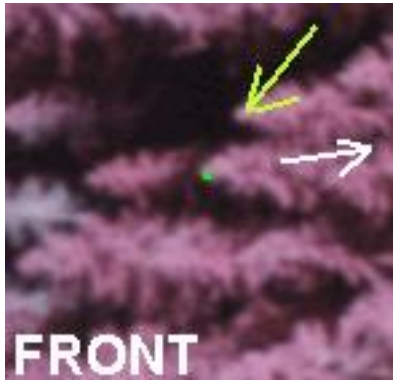
Puiden lukumäärän laskeminen



Puulajien tunnistus konenäön avulla

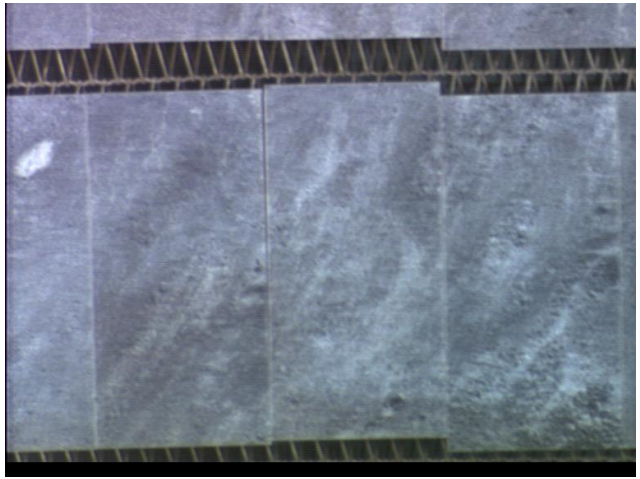


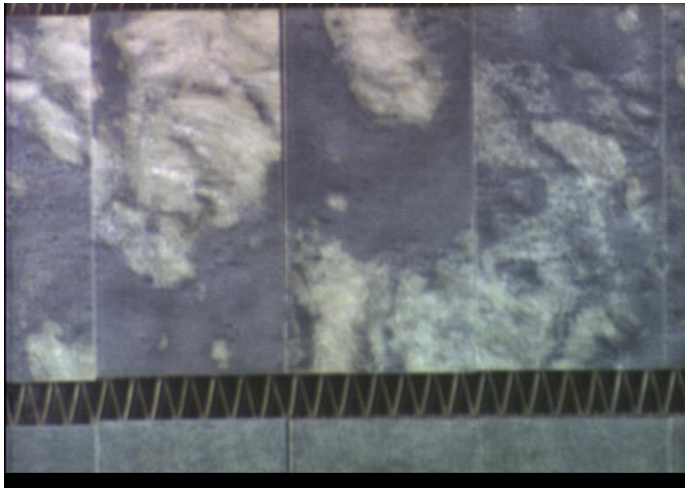




Uunien tiilien luokittelu

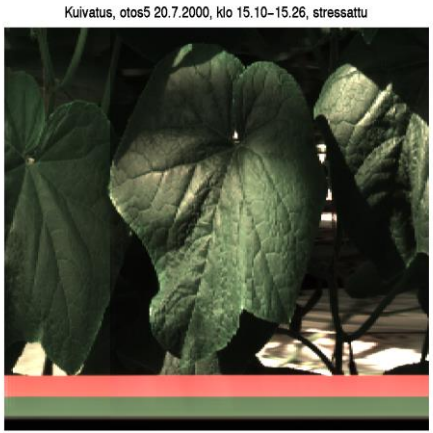
- Värikonenäkö

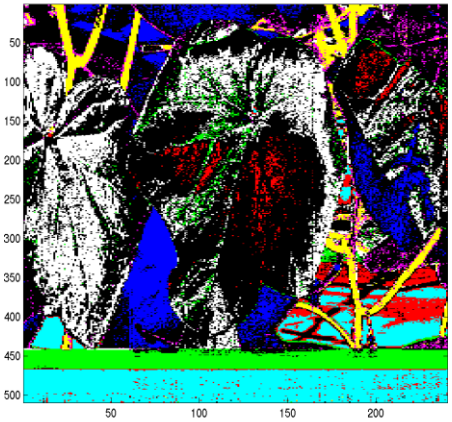




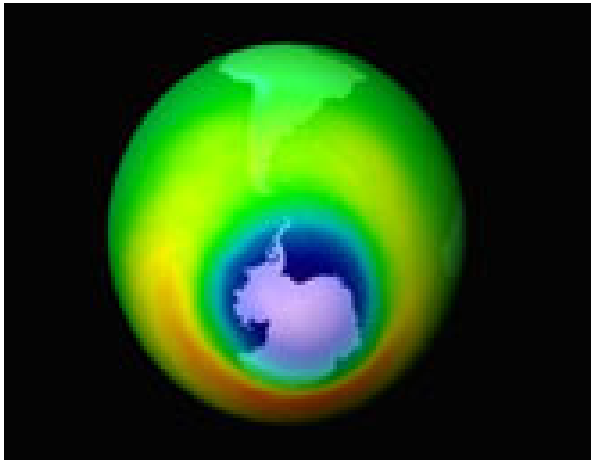
Kurkkujen hyvinvoinnin monitorointi konenäön avulla

- Spektrikamera

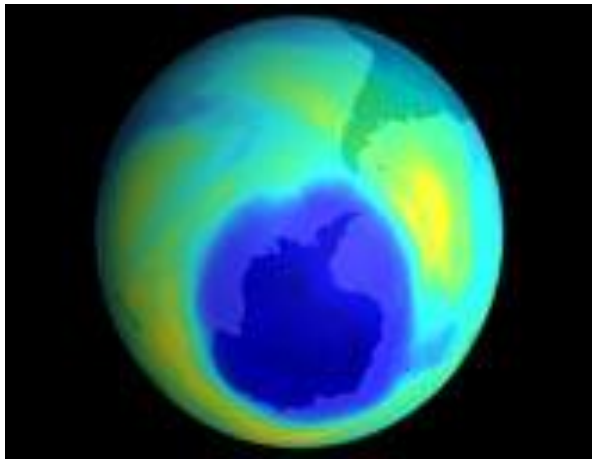




Otsoniaukon monitorointi



Kuva otettu 9 / 1999



Kuva otettu 9 / 2001

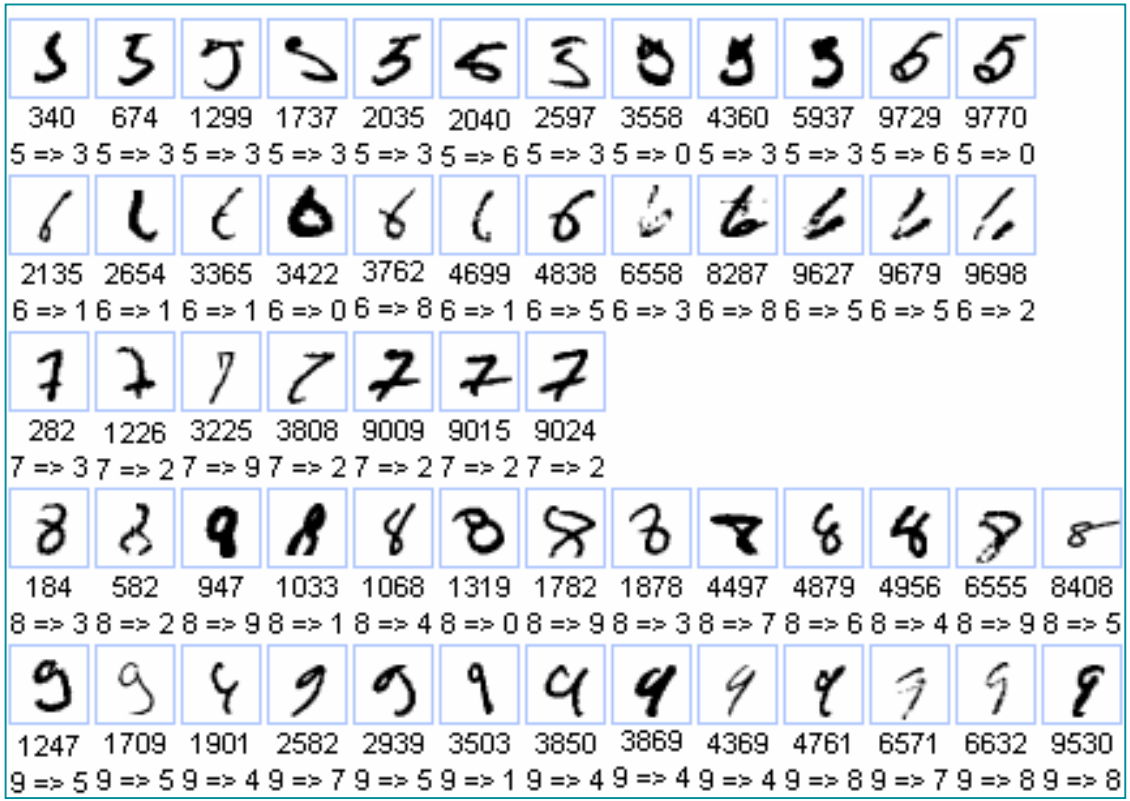
Application

Mike O'Neill

- A Convolutional neural network achieves 99.26% accuracy on a modified NIST database of hand-written digits.

- MNIST database : Consist of 60,000 hand written digits uniformly distributed over 0-9.

Application

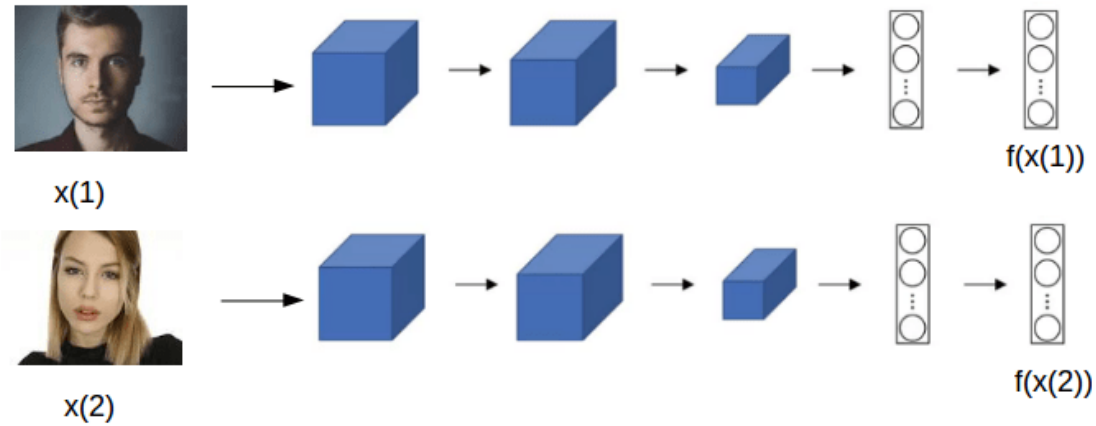


Siamese Network

We will use a Siamese network to learn the function which we defined earlier:

d(img1,img2) = degree of difference between images

Suppose we have two images, x(1) and x(2), and we pass both of them to the same ConvNet. Instead of generating the classes for these images, we extract the features by removing the final softmax layer. So, the last layer will be a fully connected layer having, say 128 neurons:

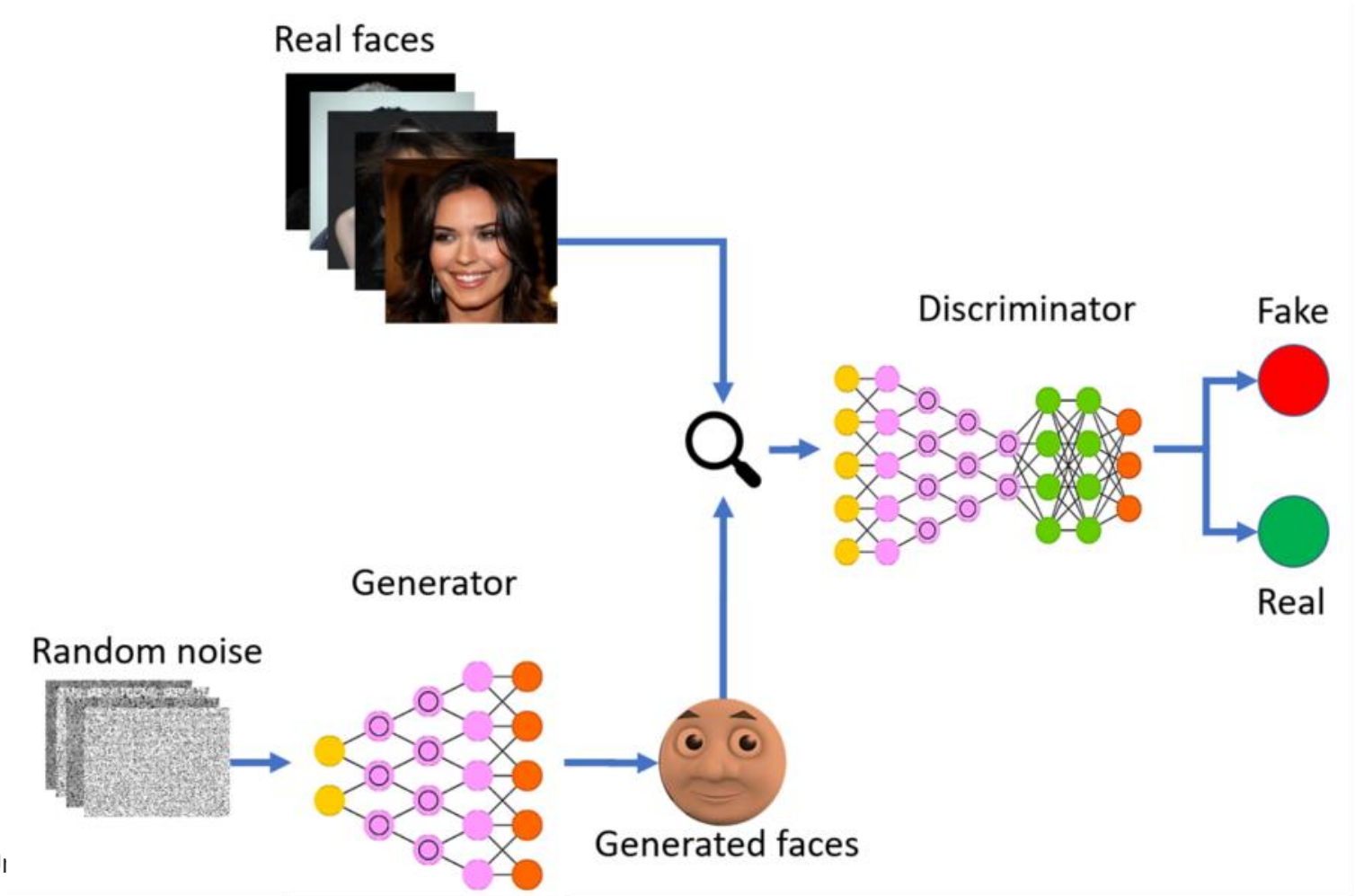


Here, f(x(1)) and f(x(2)) are the encodings of images x(1) and x(2) respectively. So,

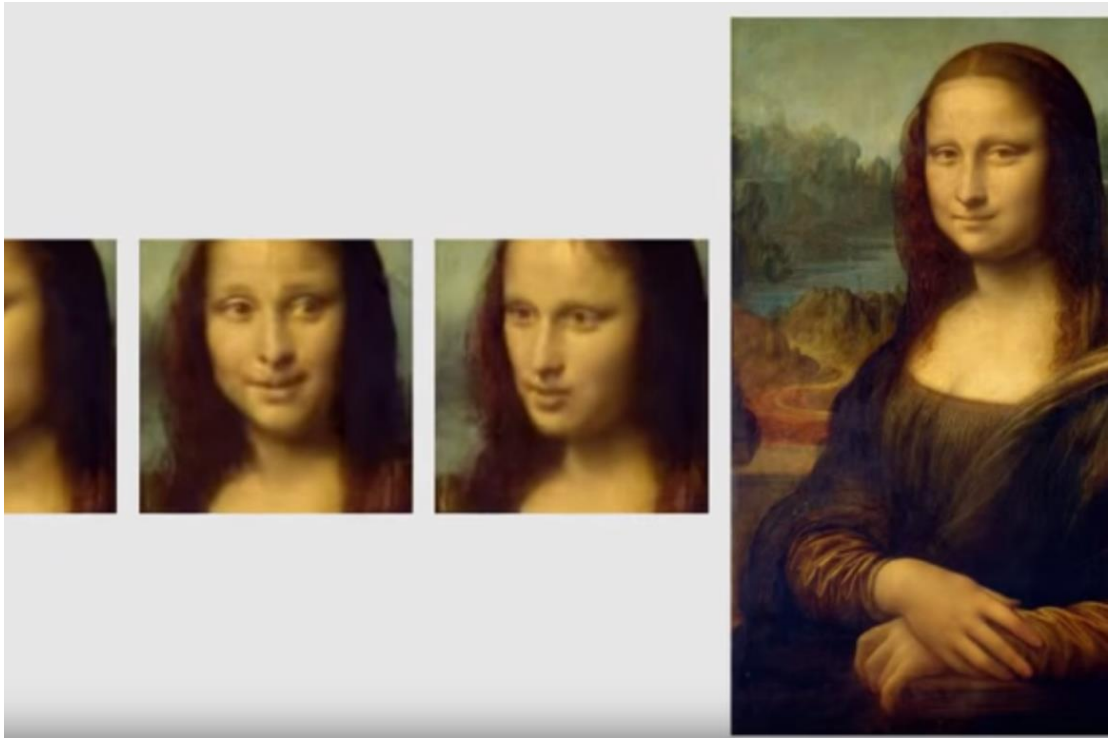
$$d(x(1),x(2)) = || f(x(1)) - f(x(2)) ||^2_2$$

We train the model in such a way that if x(i) and x(j) are images of the same person, $|| f(x(i)) - f(x(j)) ||^2$ will be small and if x(i) and x(j) are images of different people, $|| f(x(i)) - f(x(j)) ||^2$ will be large. This is the architecture of a Siamese network.

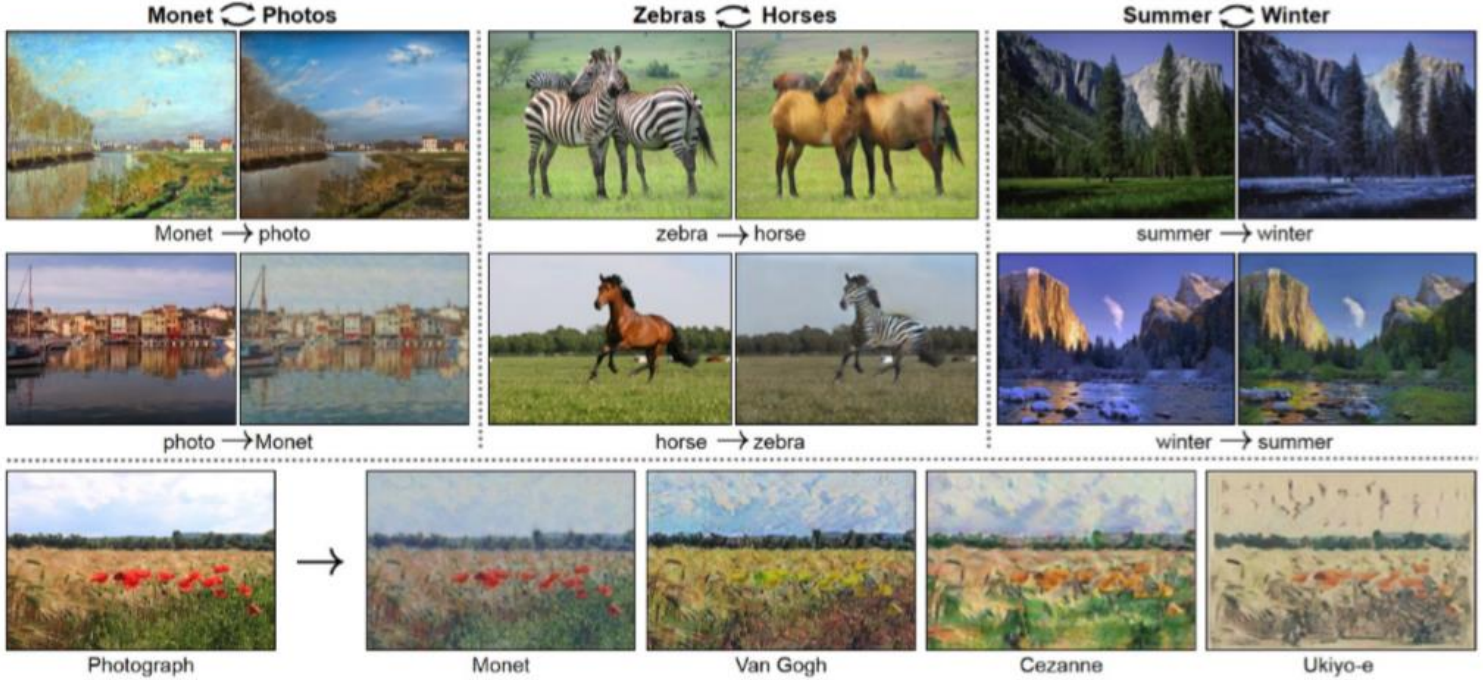
Next up, we will learn the loss function that we should use to improve a model's performance.


Real faces
Discriminator
Fake
Real
Generator
Random noise
Generated faces

Generative Adversarial Networks (GAN)



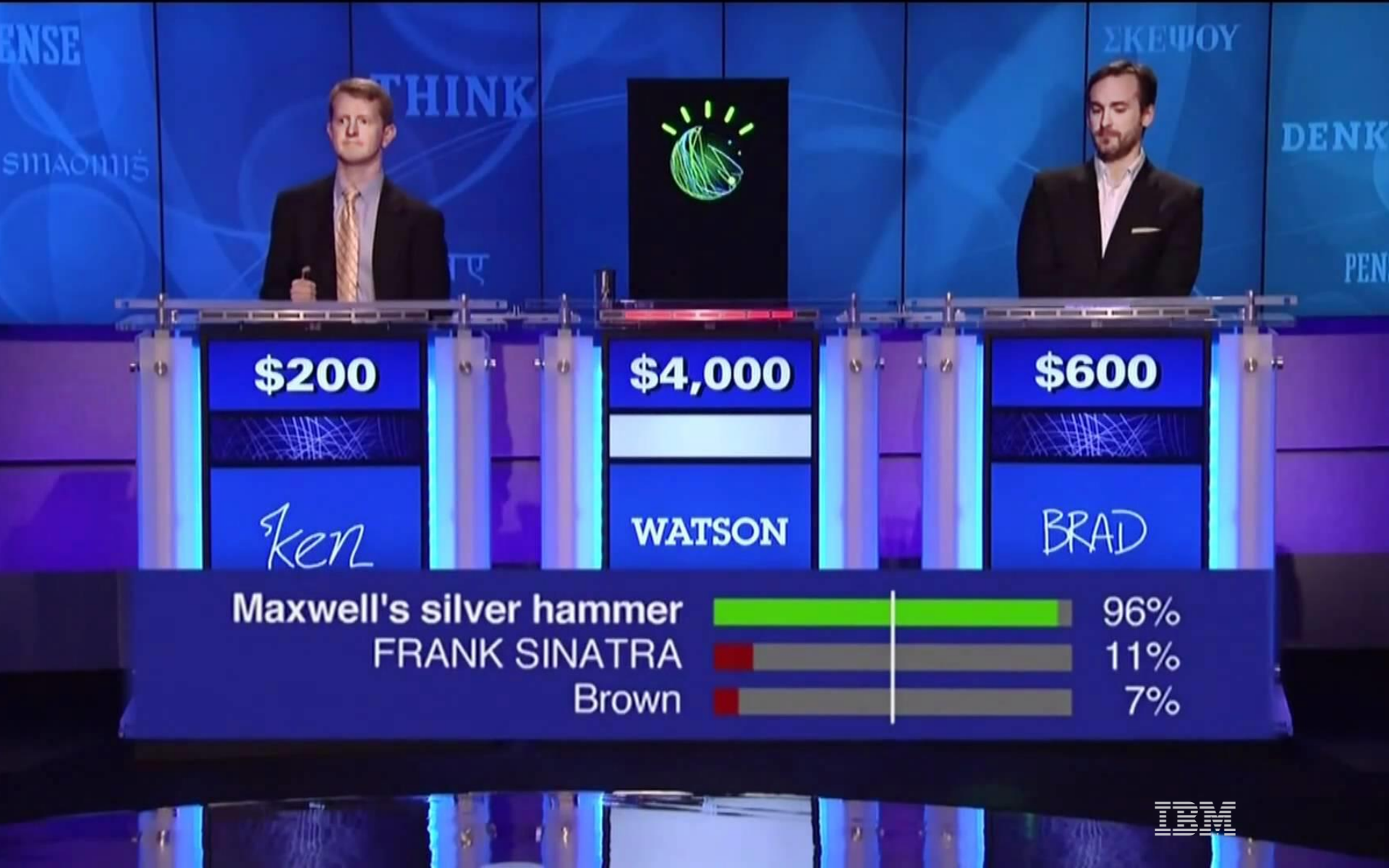
Style transfer problem: change the style of an image while preserving the content.



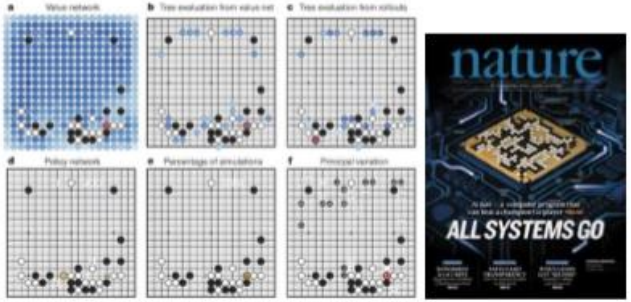
Data: Two unrelated collections of images, one for each style

Pretty Pictures from GANs

LSGAN - Least Squares Generative Adversarial Networks


$200
$4,000
$600
Ken
WATSON
BRAD
Maxwell's silver hammer
96%
FRANK SINATRA
11%
Brown
7%
IBM

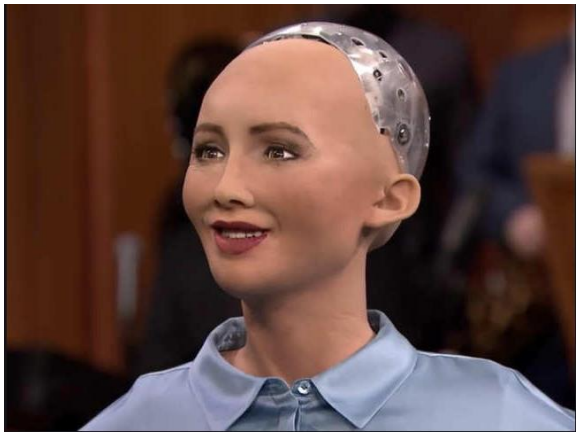
Case Study Bonus: DeepMind's AlphaGo



The input to the policy network is a 19 × 19 × 48 image stack consisting of 48 feature planes. The first hidden layer zero pads the input into a 23 × 23 image, then convolves *k* filters of kernel size 5 × 5 with stride 1 with the input image and applies a rectifier nonlinearity. Each of the subsequent hidden layers 2 to 12 zero pads the respective previous hidden layer into a 21 × 21 image, then convolves *k* filters of kernel size 3 × 3 with stride 1, again followed by a rectifier nonlinearity. The final layer convolves 1 filter of kernel size 1 × 1 with stride 1, with a different bias for each position, and applies a softmax function. The match version of AlphaGo used *k* = 192 filters; Fig. 2b and Extended Data Table 3 additionally show the results of training with *k* = 128, 256 and 384 filters.

policy network:
[19x19x48] Input
CONV1: 192 5x5 filters , stride 1, pad 2 => [19x19x192]
CONV2..12: 192 3x3 filters, stride 1, pad 1 => [19x19x192]
CONV: 1 1x1 filter, stride 1, pad 0 => [19x19] *(probability map of promising moves)*

Humanoidirobotit



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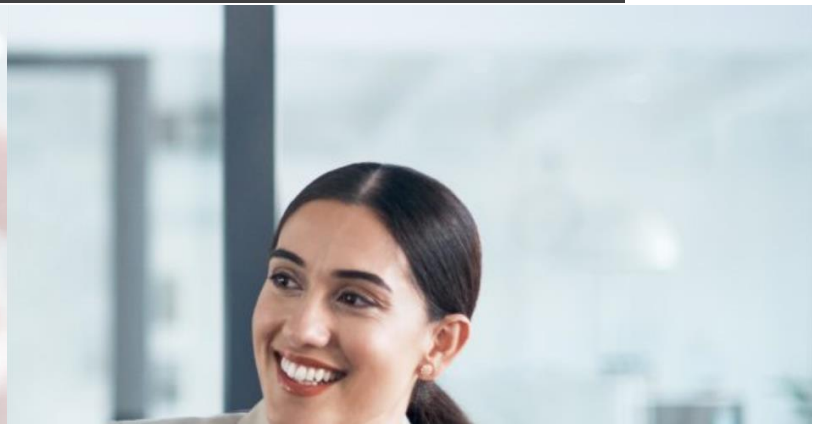
DIGICENTERIN TAVOITTEET

- Synnyttää Pohjois-Savoon digitalisaatiokeskittymä
- Seurata ja ylläpitää ajantasaista tietoa ja osaamista digitaalisista teknologioista sekä niiden kypsyysasteesta.
- Toteuttaa tutkimus- ja kehittämishankkeita digitalisaation alueella
- Ratkaisee yhdessä asiakkaiden kanssa haastavia ongelmia digitalisaation keinoin.
- Tukee asiakkaiden uuden digitekniikan käyttöönottoa

› HALUAN MUKAAN



Koordinaattorit ja rahoittajat

UNIVERSITY OF EASTERN FINLAND

SAVONIA UNIVERSITY OF APPLIED SCIENCES

Regional Council of Pohjois-Savo supports a successful region

Leverage from the EU 2014–2020

European Union European Regional Development Fund

Kiitos!

UNIVERSITY OF
EASTERN FINLAND

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