SOM for MNIST

Self Organizing Map for
MNIST handwritten digits classification

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WPROWADZENIE DO
MACHINE LEARNING

Version 1.1

Before we start…

Opinie i poglądy wyrażone w tej prezentacji są wyłącznie moje własne lub cytowane.
Nie są powiązane z żadną firmą, dla której pracuję / pracowałem.

Credits to various authors of Internet sources

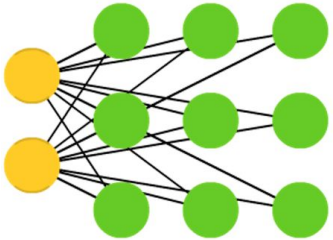
- Wikipedia https://www.wikipedia.org/
- Neural Network Zoo http://www.asimovinstitute.org/neural-network-zoo/
- MNIST http://yann.lecun.com/exdb/mnist/
- More sources inline.

Language / Język

The presentation will be delivered in Polish, slides are in Polish or English.
Prezentacja będzie wygłoszona w języku polskim, slajdy są w języku polskim lub angielskim.

Self Organizing Map (SOM)

https://en.wikipedia.org/wiki/Self-organizing_map



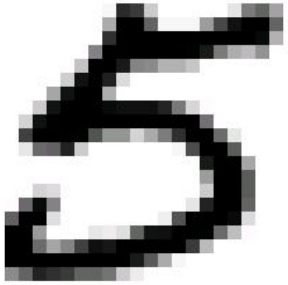
“A self-organizing map (SOM) or self-organizing feature map (SOFM) is a type of artificial neural network (ANN) that is trained using unsupervised learning to produce a low-dimensional (typically two-dimensional), discretized representation of the input space of the training samples, called a map, and is therefore a method to do dimensionality reduction. Self-organizing maps differ from other artificial neural networks as they apply competitive learning as opposed to error-correction learning (such as backpropagation with gradient descent), and in the sense that they use a neighborhood function to preserve the topological properties of the input space.”

Known as (Teuvo) **Kohonen map** or **Kohonen network**.

Colour network images taken from Neural Network Zoo: http://www.asimovinstitute.org/neural-network-zoo/

MNIST

http://yann.lecun.com/exdb/mnist/

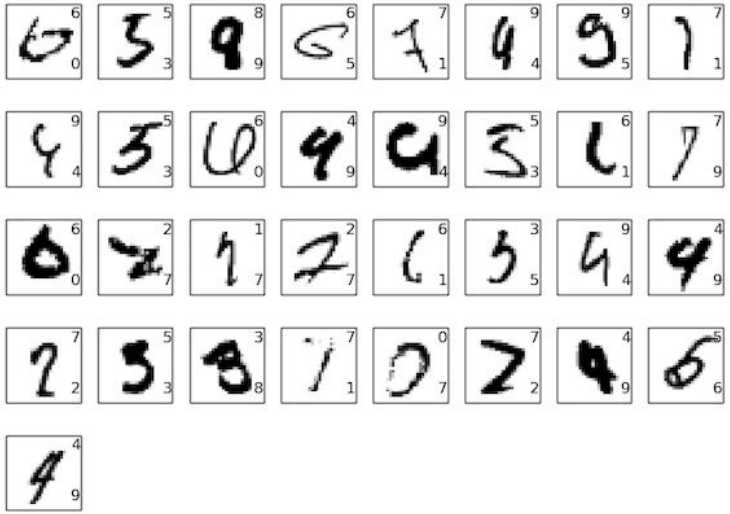


”The MNIST database of handwritten digits, available from this page, has a training set of **60,000** examples, and a test set of **10,000** examples. It is a subset of a larger set available from NIST. The digits have been size-normalized and centered in a fixed-size image (**28x28**).

It is a good database for people who want to try learning techniques and pattern recognition methods on real-world data while spending minimal efforts on preprocessing and formatting.”

Results

- 0.23 - Ciresan et al. CVPR 2012
- 0.21 - http://cs.nyu.edu/~wanli/dropc/
- …
- 0.33 - http://neuralnetworksanddeeplearning.com/chap6.html →



Motivation

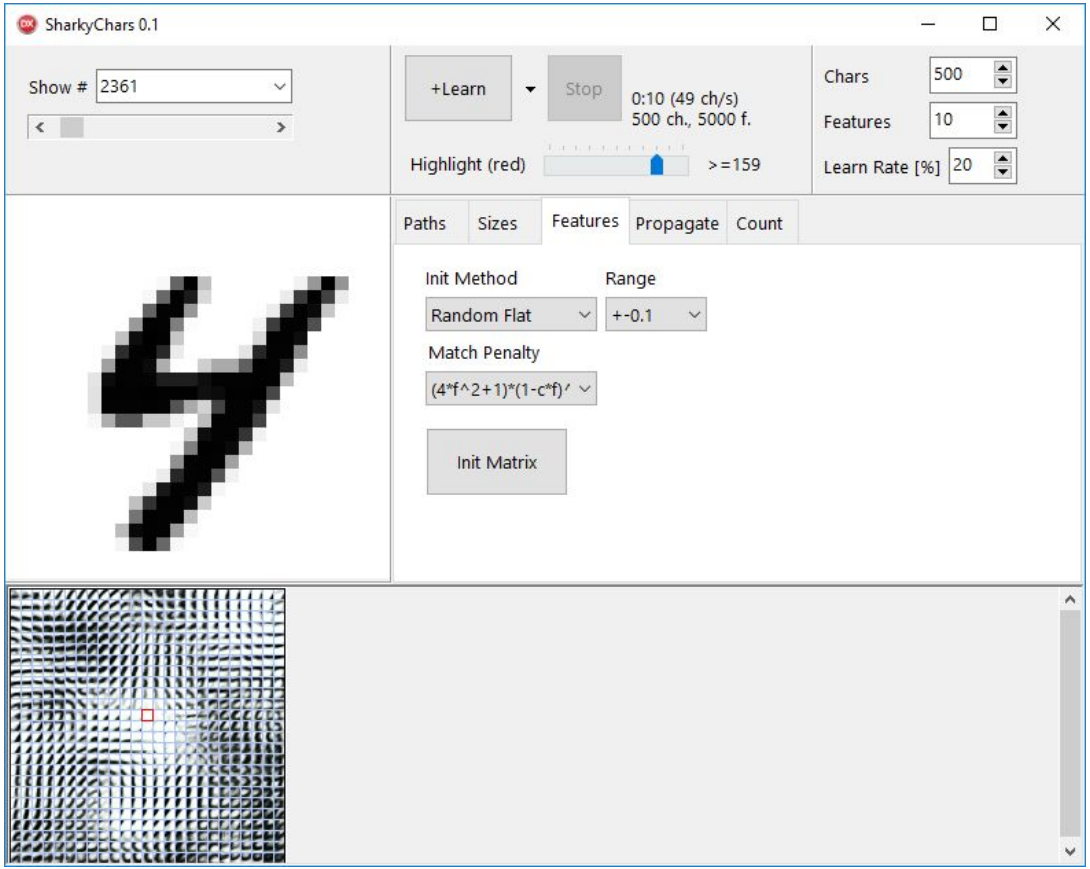
- Share, get feedback, grow, …. magic
- Data collection
- ...
- Compete MNIST

Domain knowledge

- Pen/Rubber, Pencil
  - dark lines, curves & dots
  - line's width has reasonable range
  - lines can have different darkness or width
  - lines can be broken or doubled
- Background: typically ~white with shadows & dirt
- Boundary frame is typically background
- ...

The Tool

Download **SharkyChars**
http://sharktime.com/<TBD>
GitHub: <TBD>

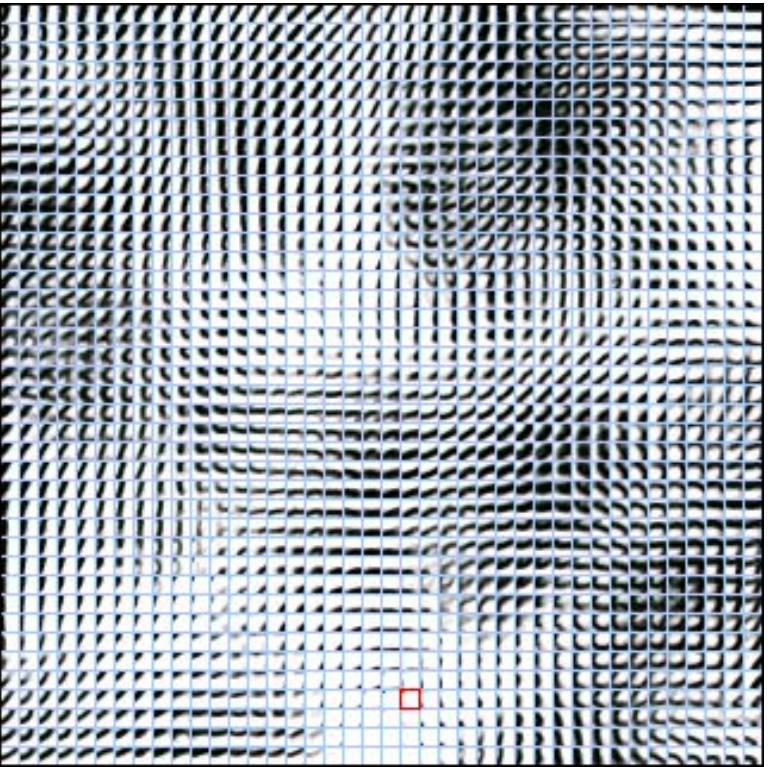


Download my other tool:

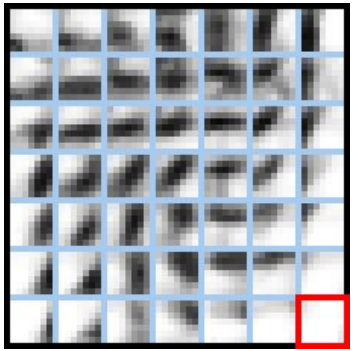
Sharky Neural Network http://sharktime.com/us_SharkyNeuralNetwork.html

Features (1)

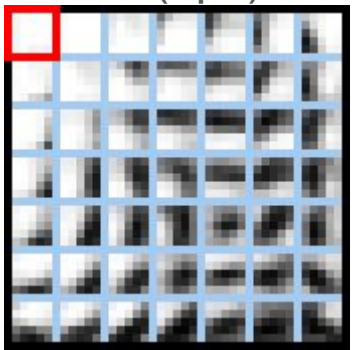
40x40



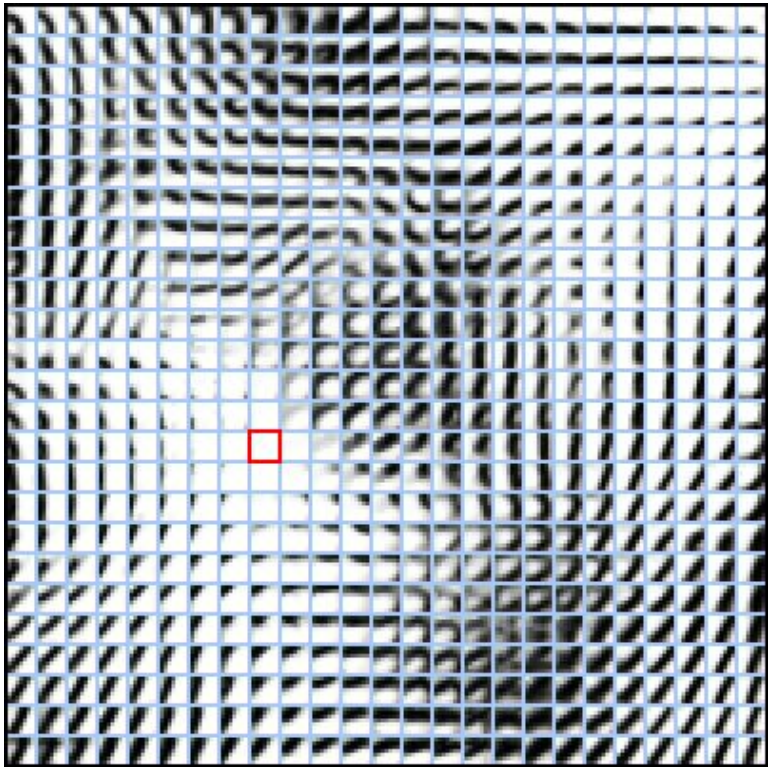
7x7 (7px)



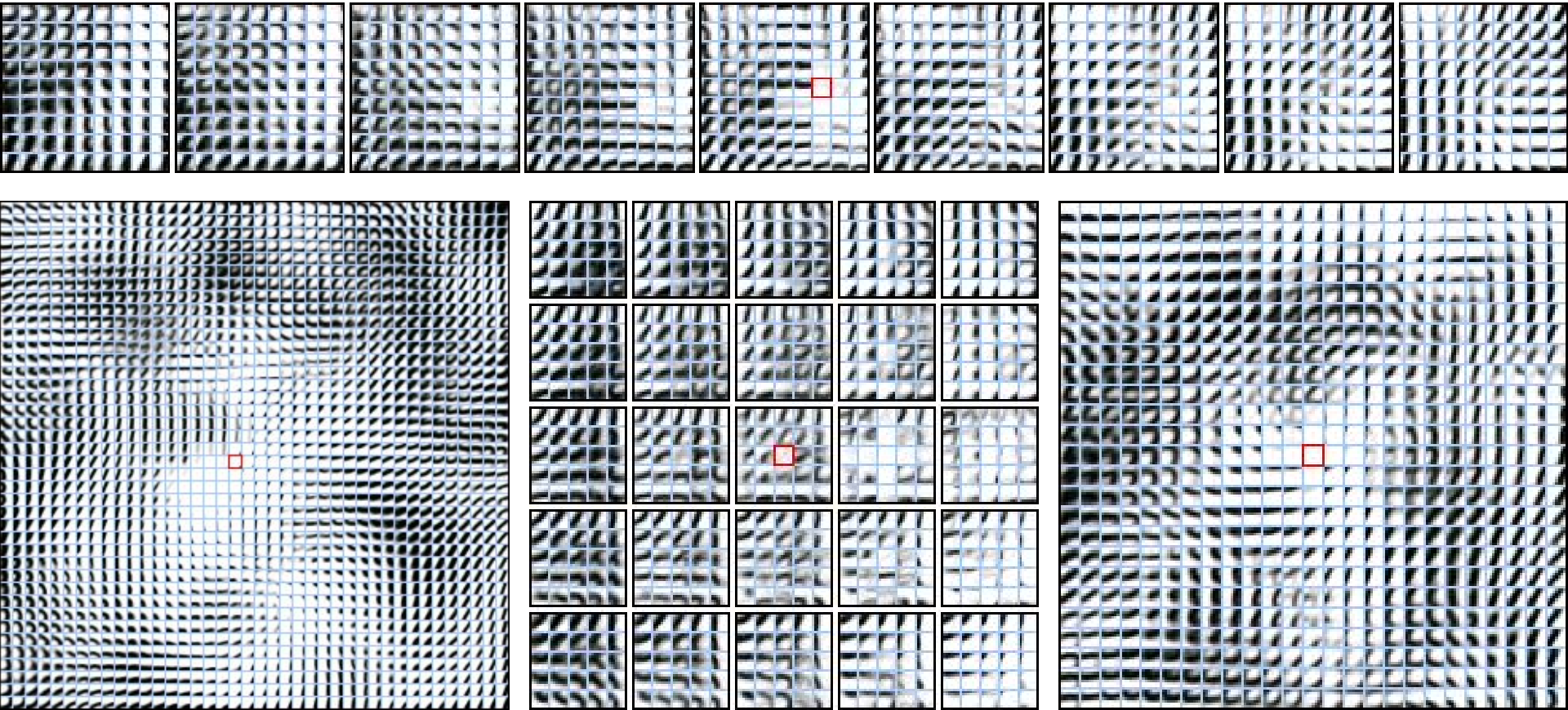
7x7 (5px)



25x25

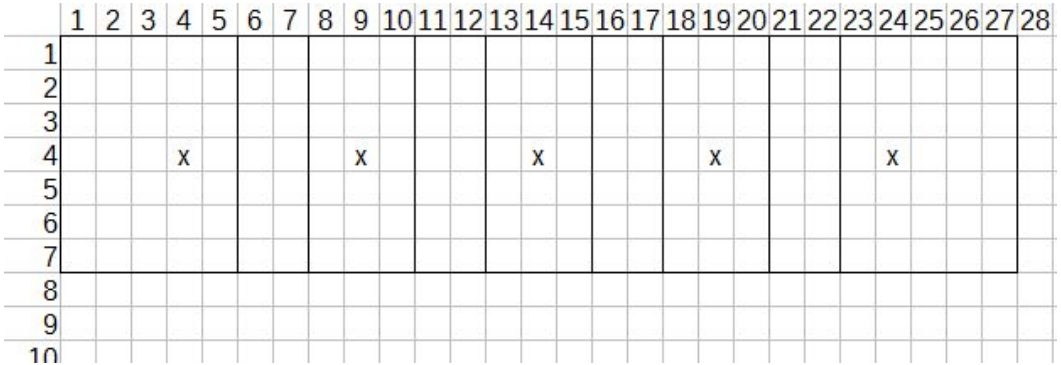


Features (2)



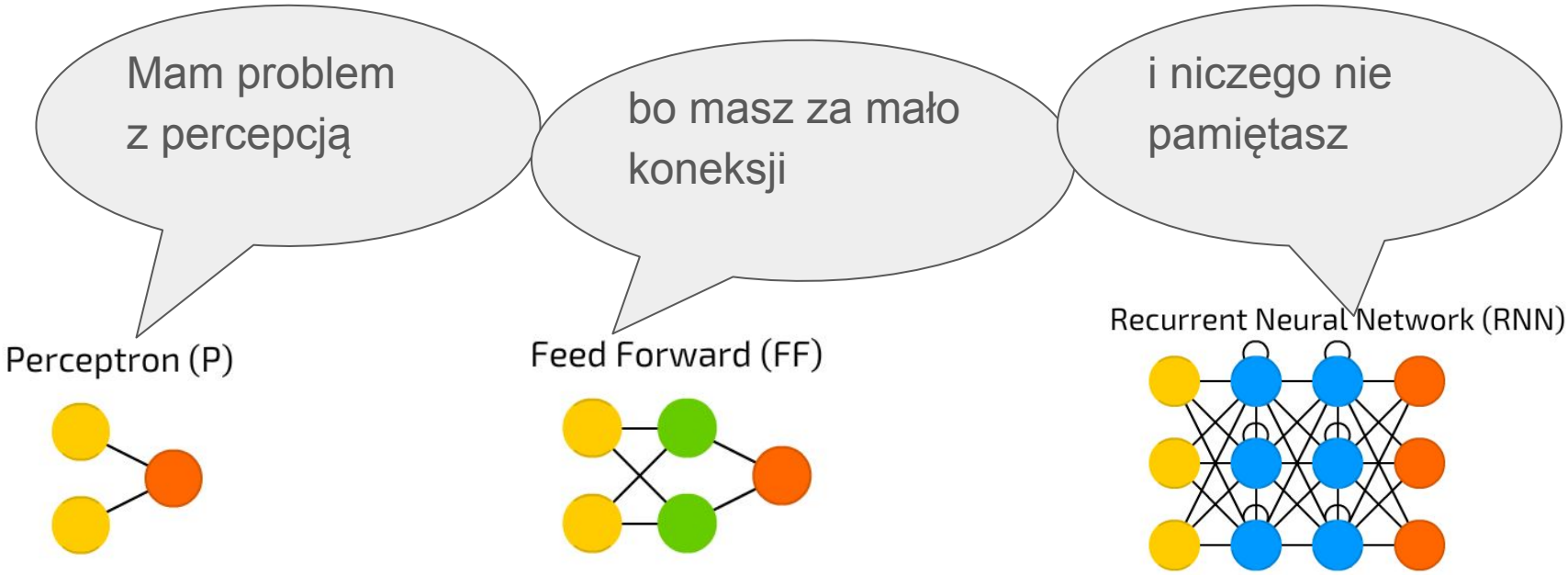
The Direction

- 3 state features (1:white, -1:black, 0:don’t care)
- change input pixels into overlapping features vector



Pytania / Suchary / Demo

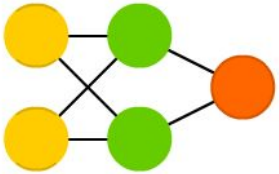
;)


Mam problem
z percepcją
Perceptron (P)
bo masz za mało
koneksji
Feed Forward (FF)
i niczego nie
pamiętasz
Recurrent Neural Network (RNN)

— by Piotr

;)

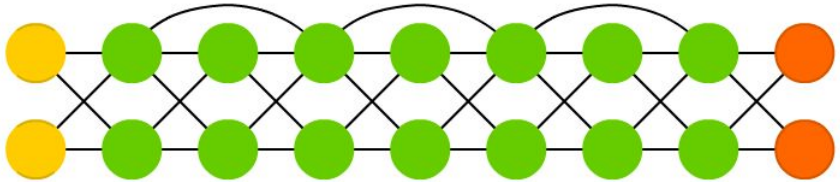
Feed Forward (FF)



Jesteś płytka!

A ja mam cię głęboko
w d..
w dolnych warstwach

Deep Residual Network (DRN)



— by Piotr

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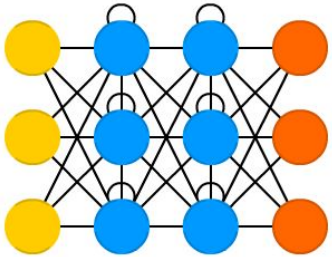
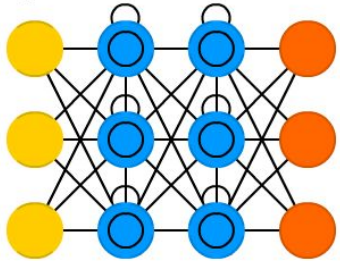
Ale jestem zakręcona

Recurrent Neural Network (RNN)



i masz krótką pamięć!

Long / Short Term Memory (LSTM)



— by Piotr

;)

“Dlaczego Kobieta jest jak Sieć Neuronowa?

Bo nikt nie ma pojęcia jak Ona naprawdę działa.”

— by Janek