

### Neural Networks Types and Main Features

**Feedforward neural network** connections between nodes do not have a cycle

**Multilayer perceptron (MLP)** has at least three layers of nodes

**Recurrent neural network (RNN)** connections between units have a directed cycle

**Self-Organising Maps (SOM)** convert input data to low dimensional space

**Deep Belief Network (DBN)** has connections between layers but not within layer

**Convolutional Neural Network (CNN)** has one or more convolutional layers and then followed by one or more fully connected layers

**Generative Adversarial Networks (GAN)** system of two neural nets, contesting with each other

**Spiking Neural Networks (SNN)** time information is processed in the form of spikes and there is more than one synapse between neurons

### Neural Networks Types and Main Features (cont)

**Wavelet neural network** use wavelet function as activation function in the neuron

**Wavelet convolutional neural network** combine wavelet transform and CNN

**Long short-term memory (LSTM)** type of RNN, model for the short-term memory which can last for a long period of time

### Building Neural Network with Keras and Python

```
from keras.models import Sequential
model = Sequential()
from keras.layers import Dense
model.add(Dense(units=64, activation='relu', input_dim=100))
model.add(Dense(units=10, activation='softmax'))
model.compile(loss='categorical_crossentropy',
              optimizer='sgd',
              metrics=['accuracy'])
model.compile(loss='keras.losses.categorical_crossentropy',
              optimizer='keras.optimizers.SGD(lr=0.01, momentum=0.9, nesterov=True))
model.fit(x_train, y_train, epochs=5, batch_size=32)
model.train_on_batch(x_batch, y_batch)
```

### Building Neural Network with Keras and Python (cont)

```
> loss_and_metrics = model.evaluate(-x_test, y_test, batch_size=128)
classes = model.predict(x_test, batch_size=128)
```

Keras

### Data Preparation for Input to Neural Network

```
from sklearn import preprocessing
def normalize_data(m, XData):
    if m == "":
        m="scaling - no"
    if m == "scaling-no":
        return XData
    if m == "StandardScaler":
        std_scale = preprocessing.StandardScaler().fit(XData)
        XData_new = std_scale.transform(XData)
        if m == "MinMaxScaler":
            min_max_scale = preprocessing.MinMaxScaler().fit(XData)
            XData_new = minmax_scale.transform(XData)
    return XData_new
```

### Cheat Sheets about Python and Machine Learning

Quick and Easy Way to get started with common and most used python tasks in data processing



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### Neural Network Applications and Most Used Networks

Image classification	CNN
Image recognition	CNN
Time series prediction	RNN, LSTM
Text generation	RNN, LSTM
Classification	MLP
Visualization	SOM

### Neural Net Weight Update Methods

Adam	based on adaptive estimates of lower order moments
AdaGrad	Adagrad is an adaptive learning rate method
RMSProp	adaptive learning rate method, modification of Adagrad method
SGD	Stochastic gradient descent
AdaDelta	modification of Adagrad to reduce its aggressive, monotonically decreasing learning rate
Newton method	second order method, is not used in deep learning
Momentum	method that helps accelerate SGD in the relevant direction

### Neural Net Weight Update Methods (cont)

Nesterov accelerated gradient	evaluate the gradient at next position instead of current
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### References:

ADAM: A METHOD FOR STOCHASTIC OPTIMIZATION  
 Convolutional Neural Networks for Visual Recognition.  
 An overview of gradient descent optimization algorithms  
 Wikipedia -Artificial neural network

### Links

[Neural Networks with Python on the Web](#)  
[Time Series Prediction with LSTM](#)  
[Recurrent Neural Networks in Python with Keras](#)  
[Implementing a recurrent neural network in python](#)  
[Time Series Prediction with Convolutional Neural Networks and Keras](#)



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