Kecerdasan Buatan

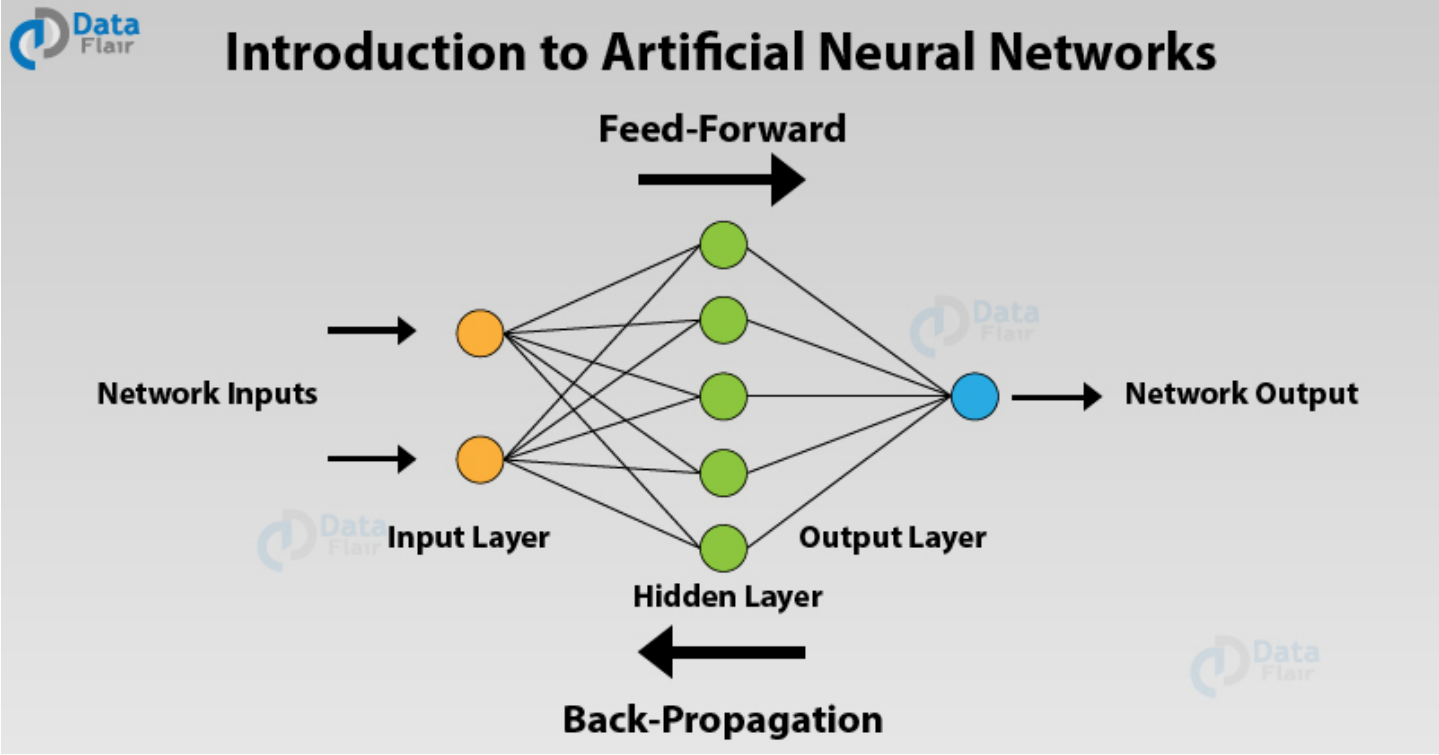
Artificial Neural Network

Department of Information and Computer Engineering
Politeknik Elektronika Negeri Surabaya

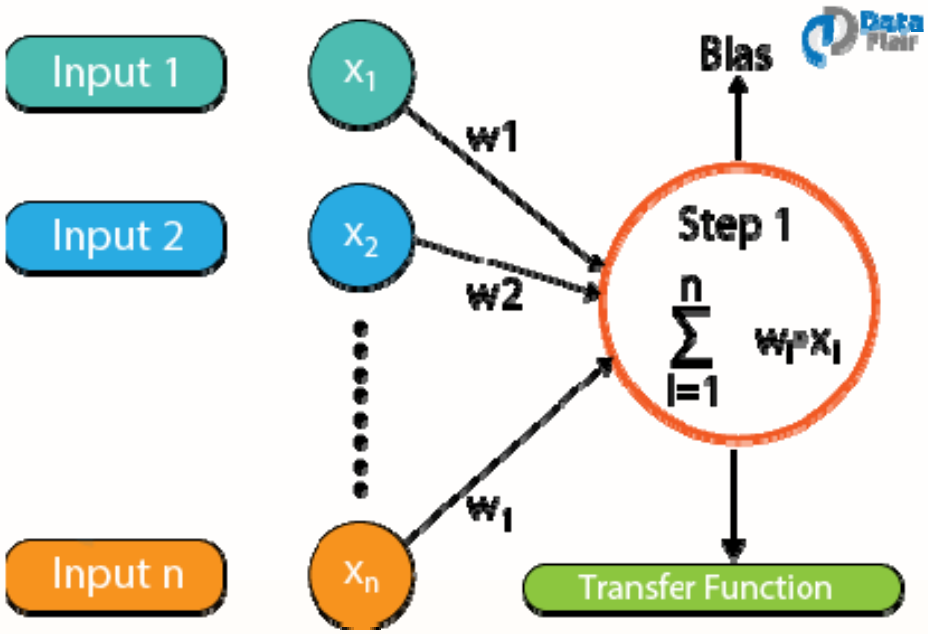
Politeknik Elektronika Negeri Surabaya
Departemen Teknik Informatika dan Komputer

Konten

- Review Artificial Neural Network
- Aplikasi Artificial Neural Network


Introduction to Artificial Neural Networks
Feed-Forward
Network Inputs
Network Output
Input Layer
Output Layer
Hidden Layer
Back-Propagation

Artificial Neural Networks Architecture



https://data-flair.training/blogs/artificial-neural-networks-for-machine-learning/

Input Layers

The input layer is the first layer of an ANN that receives the input information in the form of various texts, numbers, audio files, image pixels, etc.

Hidden Layers

- In the middle of the ANN model are the hidden layers.
- There can be a single hidden layer, as in the case of a perceptron or multiple hidden layers.
- These hidden layers perform various types of mathematical computation on the input data and recognize the patterns that are part of.

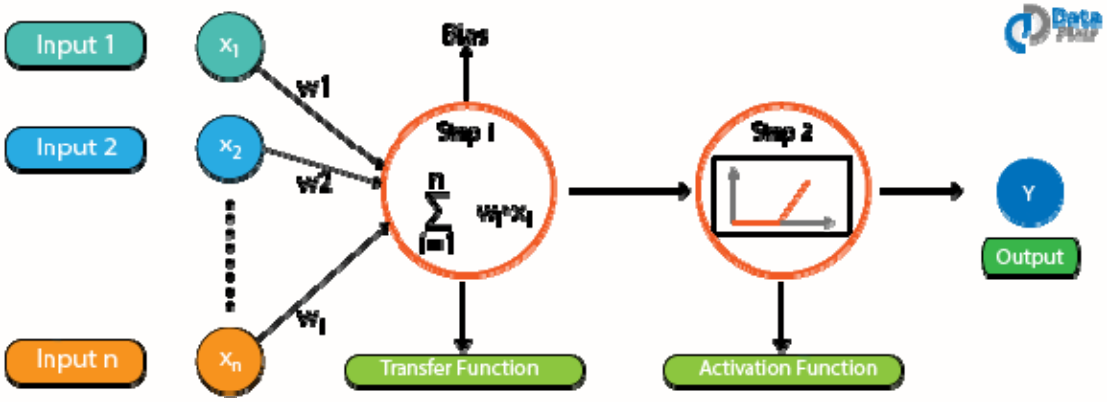
Output Layer

In the output layer, we obtain the result that we obtain through rigorous computations performed by the middle layer.

Parameters and hyperparameters

- In a neural network, there are multiple parameters and hyperparameters that affect the performance of the model.
- The output of ANNs is mostly dependent on these parameters.
- Some of these parameters are:
  - weights,
  - biases,
  - learning rate,
  - batch size etc.
- Each node in the network has some weights assigned to it.

Activation functions

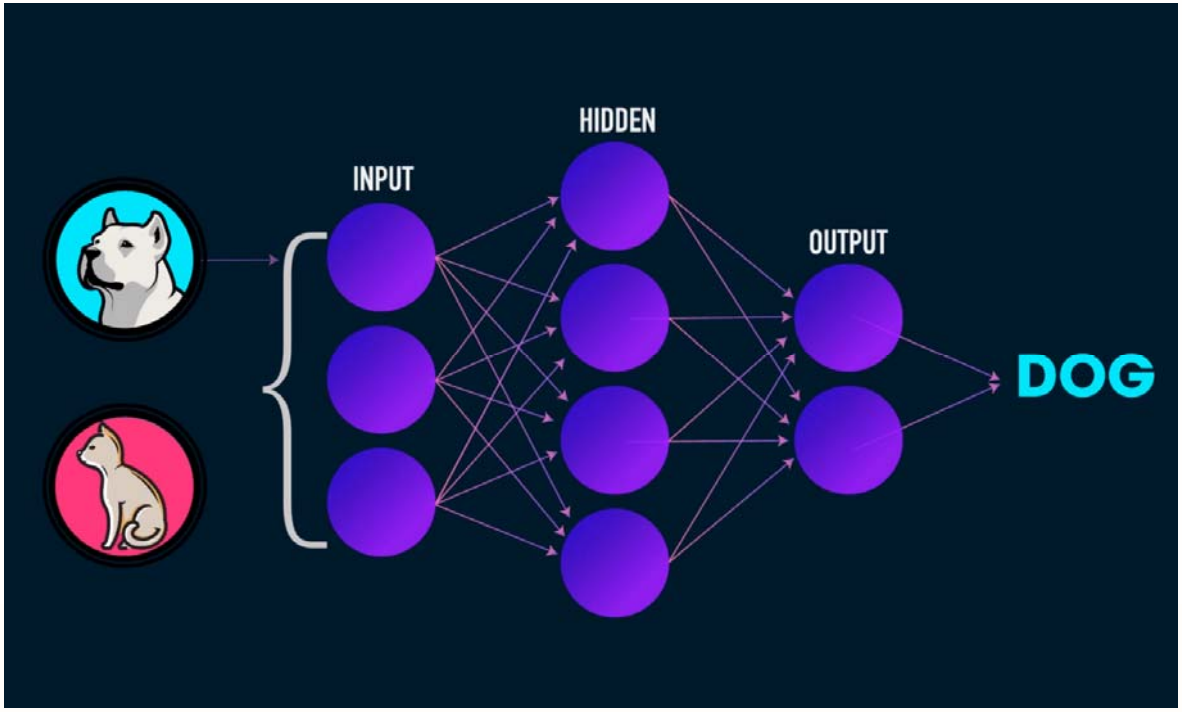


https://data-flair.training/blogs/artificial-neural-networks-for-machine-learning/

- A transfer function is used for calculating the weighted sum of the inputs and the bias.
- After the transfer function has calculated the sum, the activation function obtains the result.
- Based on the output received, the activation functions fire the appropriate result from the node.
- **For example**, if the output received is above 0.5, the activation function fires a 1 otherwise it remains 0.
- Some of the popular activation functions used in Artificial Neural Networks are Sigmoid, RELU, Softmax, tanh etc.

Error Functions

- Based on the value that the node has fired, we obtain the final output.
- Then, using the error functions, we calculate the discrepancies between the predicted output and resulting output and adjust the weights of the neural network through a process known as ***backpropagation***.



Back Propagation in Artificial Neural Networks

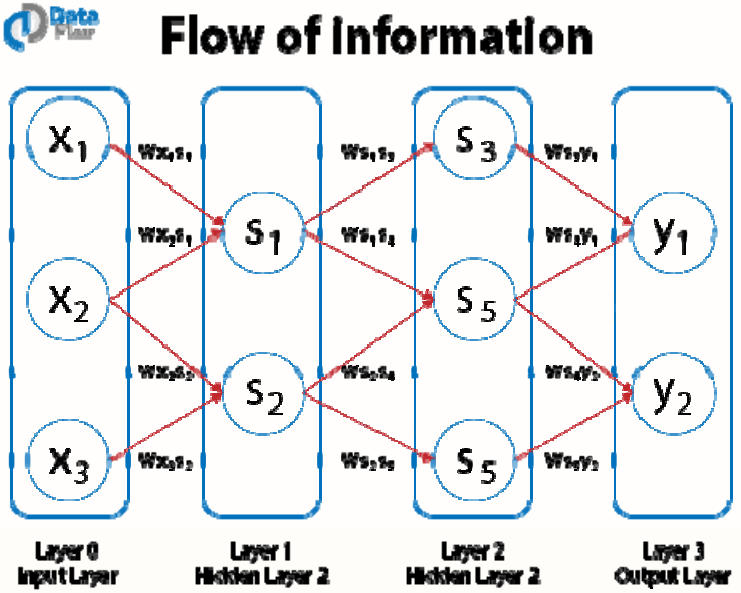
- In order to train a neural network, we provide it with examples of input-output mappings.
- Finally, when the neural network completes the training, we test the neural network where we do not provide it with these mappings.
- The neural network predicts the output and we evaluate how correct the output is using the various error functions.
- Finally, based on the result, the model adjusts the weights of the neural networks to optimize the network following gradient descent through the chain rule.

Types of Artificial Neural Networks

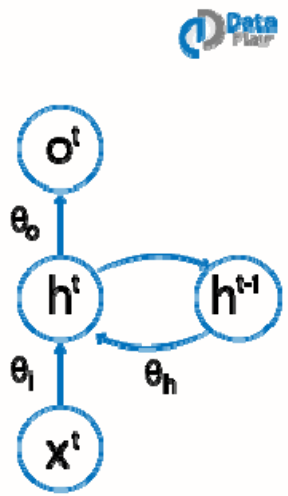
- There are two important types of Artificial Neural Networks
  - FeedForward Neural Network
  - FeedBack Neural Network

FeedForward Artificial Neural Networks

- In the feedforward ANNs, the flow of information takes place only in one direction.
- That is, the flow of information is from the input layer to the hidden layer and finally to the output.
- There are no feedback loops present in this neural network.
- These type of neural networks are mostly used in ***supervised learning*** for instances such as classification, image recognition etc.
- We use them in cases where the data is not sequential in nature.

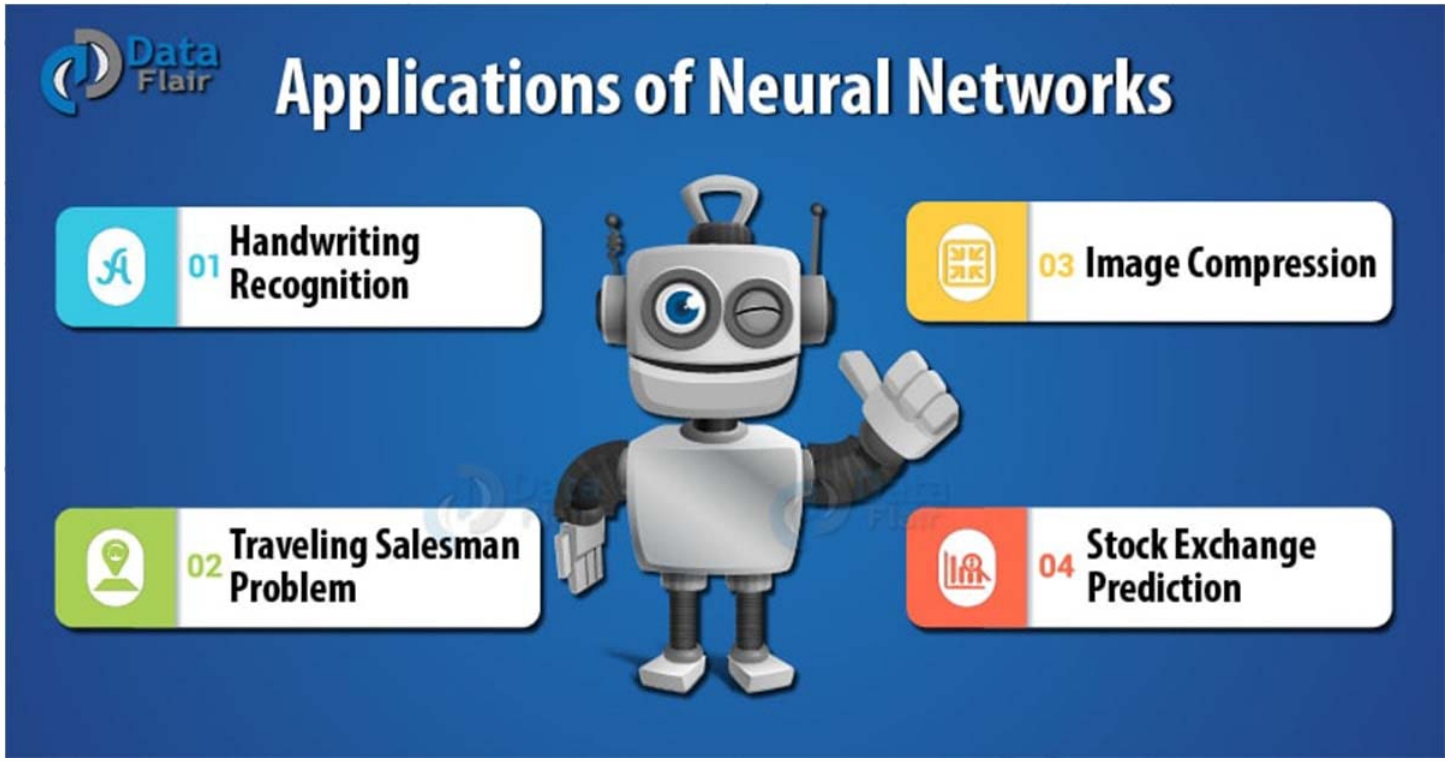


Feedback Artificial Neural Networks



- In the feedback ANNs, the feedback loops are a part of it.
- Such type of neural networks are mainly for memory retention such as in the case of recurrent neural networks.
- These types of networks are most suited for areas where the data is sequential or time-dependent.

Artificial Neural Networks Applications

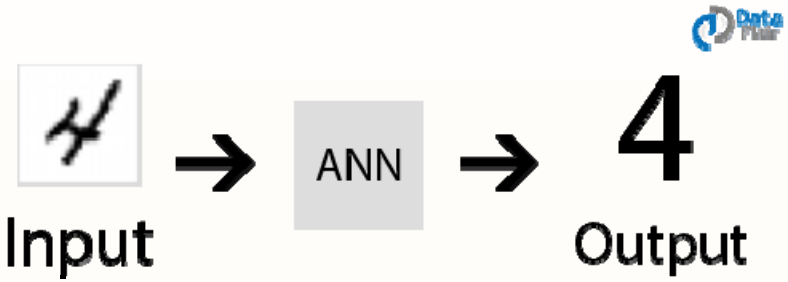


Artificial Neural Networks Applications

- Handwritten Character Recognition
- Speech Recognition
- Signature Classification
- Facial Recognition

Handwritten Character Recognition

- ANNs are used for handwritten character recognition.
- Neural Networks are trained to recognize the handwritten characters which can be in the form of letters or digits.
- The bitmap pattern of the handwritten character is input, with the correct letter or digit as the desired output.
- Such programs need the user to train the network by providing the program with their handwritten patterns.

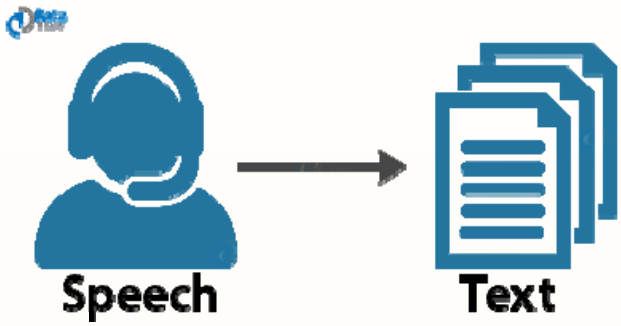


Handwritten Character Recognition

- The two common applications of handwriting recognition are:
  - Optical character recognition for data entry
  - Validation of signatures on a bank cheque

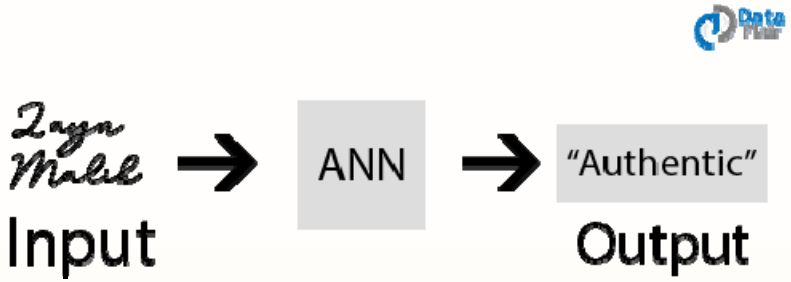
Speech Recognition

- ANNs play an important role in speech recognition.
- The earlier models of Speech Recognition were based on statistical models like Hidden Markov Models.
- With the advent of deep learning, various types of neural networks are the absolute choice for obtaining an accurate classification.



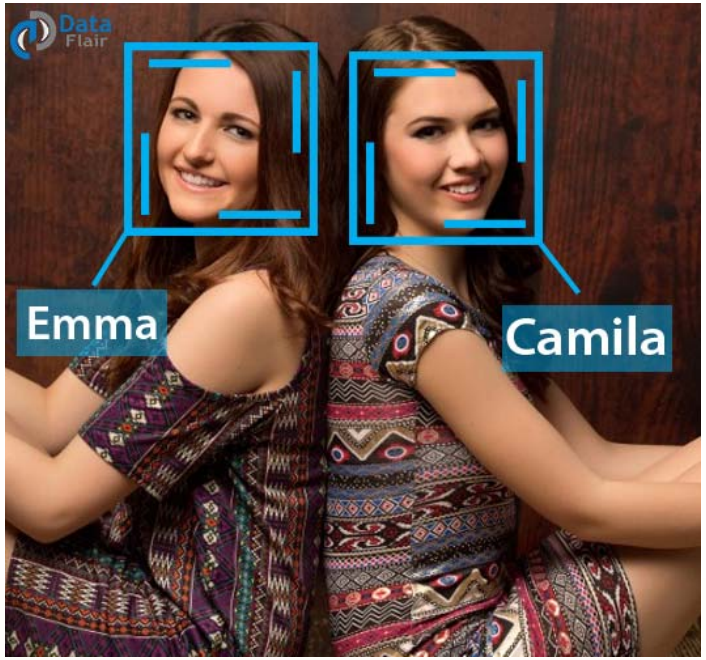
Signature Classification

- For recognizing signatures and categorizing them to the person's class, we use artificial neural networks for building these systems for authentication.
- Furthermore, neural networks can also classify if the signature is fake or not.



Facial Recognition

- In order to recognize the faces based on the identity of the person, we make use of neural networks.
- They are most commonly used in areas where the users require security access.
- Convolutional Neural Networks are the most popular type of ANN used in this field.



Tugas

1. **[25-29] Simple Neural Networks in Python,**
   - Aidan Wilson, 2019
   - https://towardsdatascience.com/inroduction-to-neural-networks-in-python-7e0b422e6c24

2. **[21-24] How to build your own Neural Network from scratch in Python**
   - James Loy. 2018
   - A beginner's guide to understanding the inner workings of Deep Learning
   - https://towardsdatascience.com/how-to-build-your-own-neural-network-from-scratch-in-python-68998a08e4f6

3. **[17-20] How to create a simple neural network in Python**
   - Dr. Michael J. Garbade, 2019
   - https://www.kdnuggets.com/2018/10/simple-neural-network-python.html

Tugas

4. **[13-16] Neural Networks from Scratch with Python Code and Math in Detail— I**
   - Building neural networks from scratch. From the math behind them to step-by-step implementation coding samples in Python with Google Colab
   - Towards AI Team Towards AI Team Follow, Jun 20, 2020
   - https://pub.towardsai.net/building-neural-networks-from-scratch-with-python-code-and-math-in-detail-i-536fae5d7bbf

5. **[9-12] Neural Networks are Function Approximation Algorithms**
   - Jason Brownlee, 2020
   - https://machinelearningmastery.com/neural-networks-are-function-approximators/

6. **[5-8] Develop a Neural Network for Cancer Survival Dataset**
   - Jason Brownlee, 2021
   - https://machinelearningmastery.com/neural-network-for-cancer-survival-dataset/

7. **[1-4] Python AI: How to Build a Neural Network & Make Predictions**
   - Déborah Mesquita Mar 17, 2021
   - https://realpython.com/python-ai-neural-network/\

Referensi

- Artificial Neural Networks for Machine Learning – Every aspect you need to know about, https://data-flair.training/blogs/artificial-neural-networks-for-machine-learning/

bridge to the future

http://www.eepis-its.edu