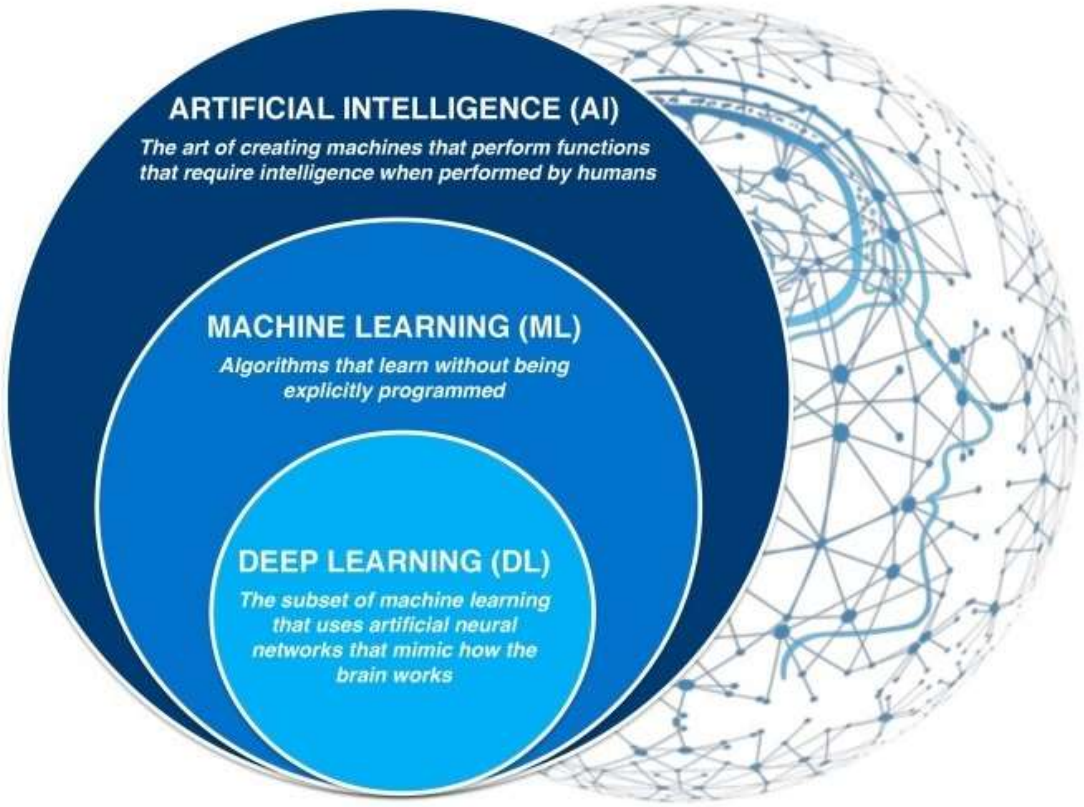
Artificial Neural Networks

Shopping Assistant using Deep Learning Model (DNN)

Name: Mert DUMANLI

Student ID: 160315002 – NORMAL



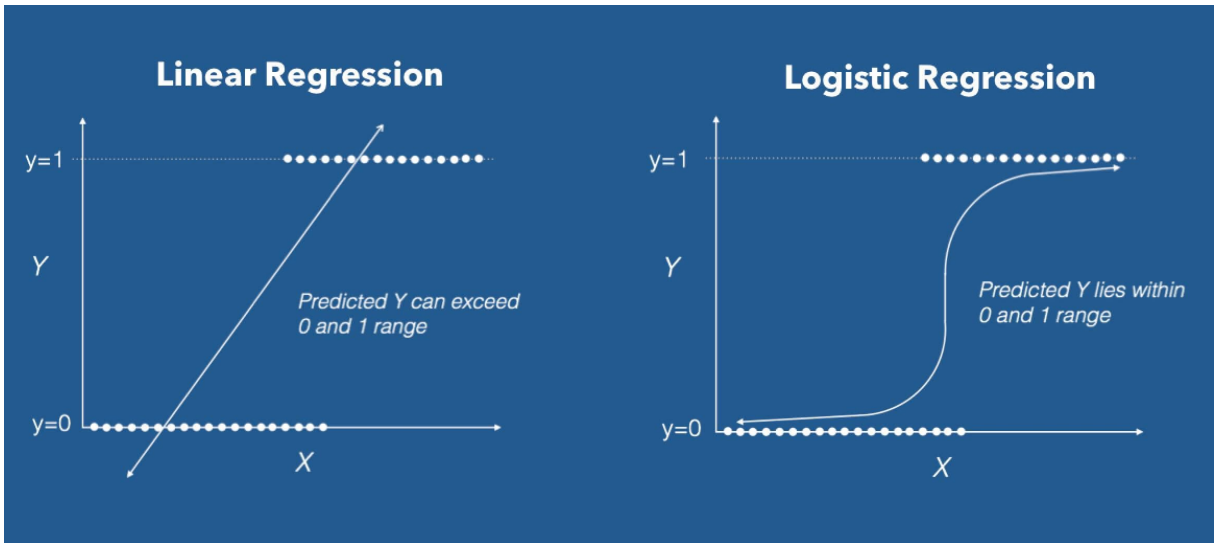
Logistic Regression

Logistic regression is a classification algorithm used to assign observations to a discrete set of classes. Some of the examples of classification problems are Email spam or not spam, online transactions Fraud or not Fraud, Tumour Malignant or Benign. Logistic regression transforms its output using the logistic sigmoid function, the hyperbolic (tanh) tangent function or rectified linear activation function (ReLu) to return a probability value.

What are the types of logistic regression?

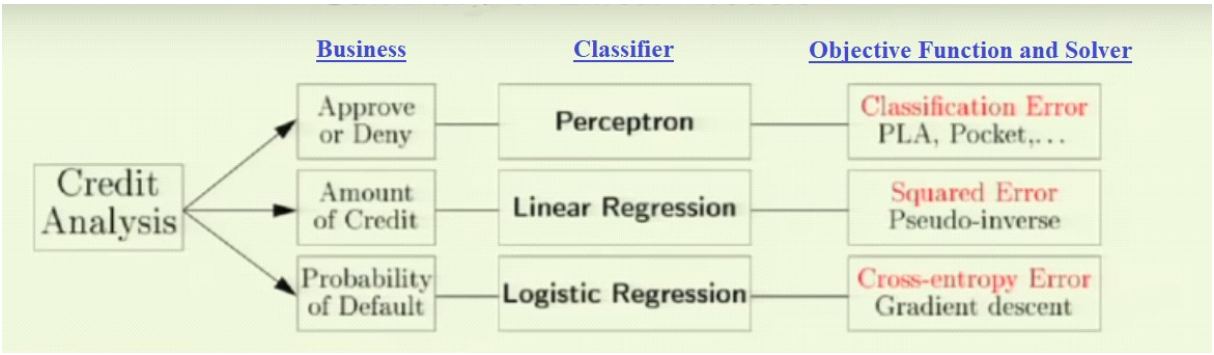
1. *Binary (eg. Tumour Malignant or Benign)*
2. *Multi-linear functions fails Class (eg. Cats, dogs or Sheep's)*

Logistic Regression is a Machine Learning algorithm which is used for the classification problems, it is a predictive analysis algorithm and based on the concept of probability.

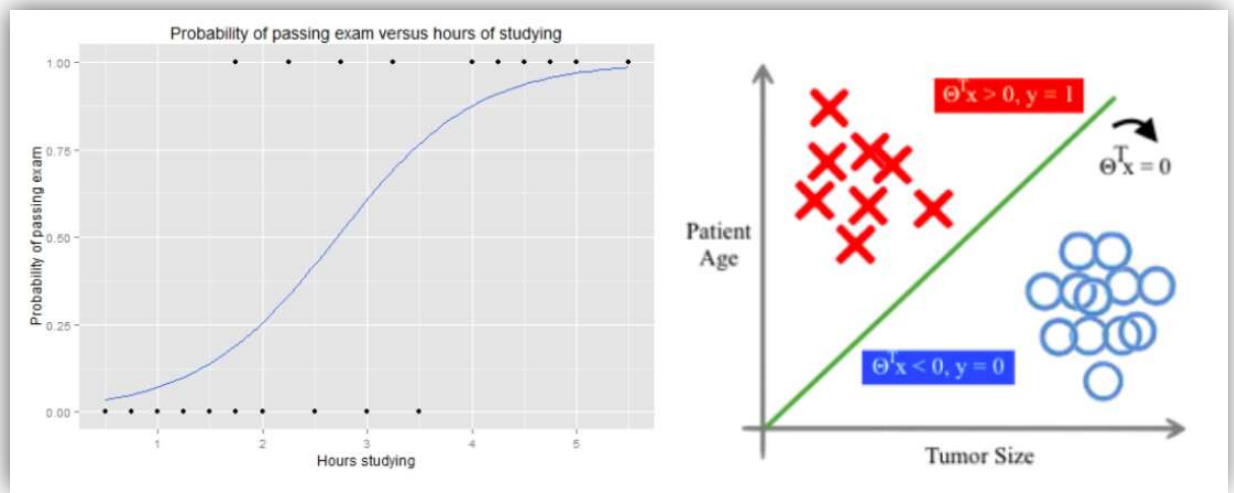


Linear Regression VS Logistic Regression Graph| Image: Data Camp

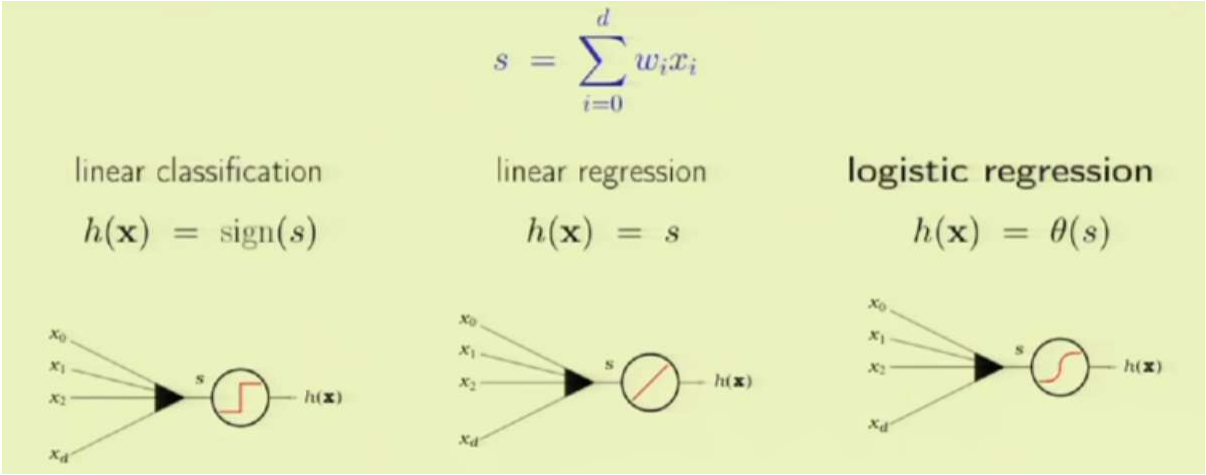
Logistic Regression is a 'Statistical Learning' technique categorized in 'Supervised' Machine Learning (ML) methods dedicated to 'Classification' tasks. It has gained a tremendous reputation for last two decades especially in financial sector due to its prominent ability of detecting defaulters. A general usage schema of Logistic Regression and other popular Linear Classifiers given below.



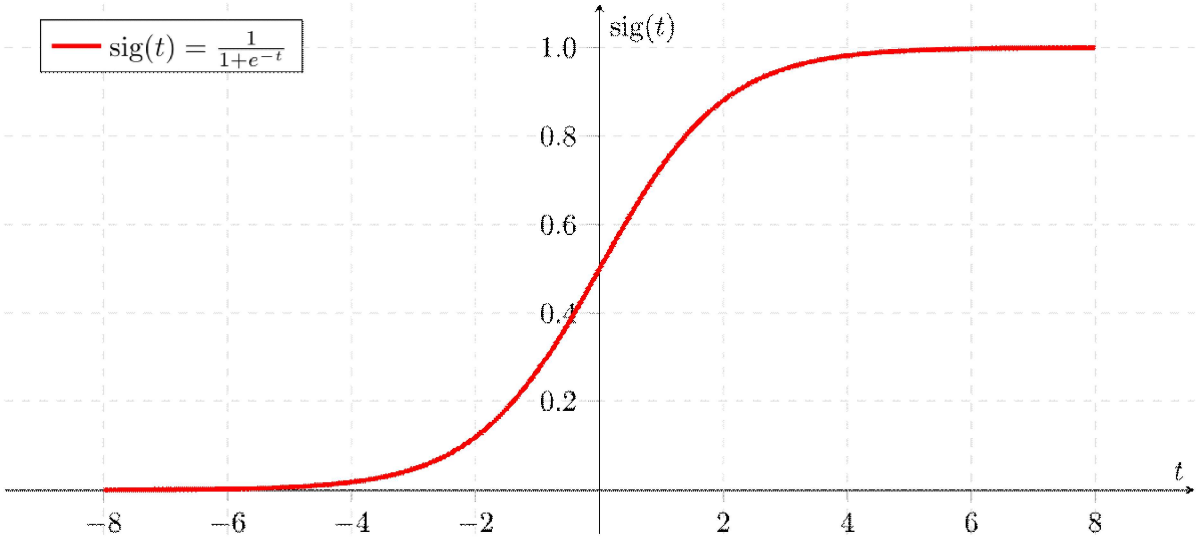
Linear Classifiers and their Usage



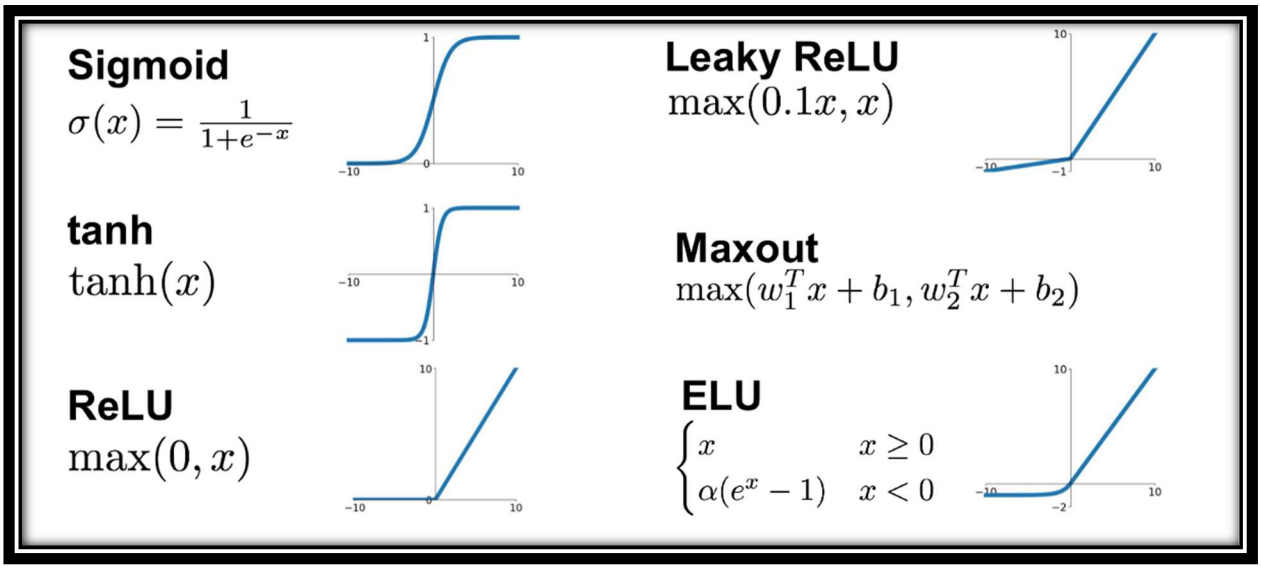
A Journey from Decision Function to Decision Boundary



Activation Function Comparison for Three Linear Classifiers

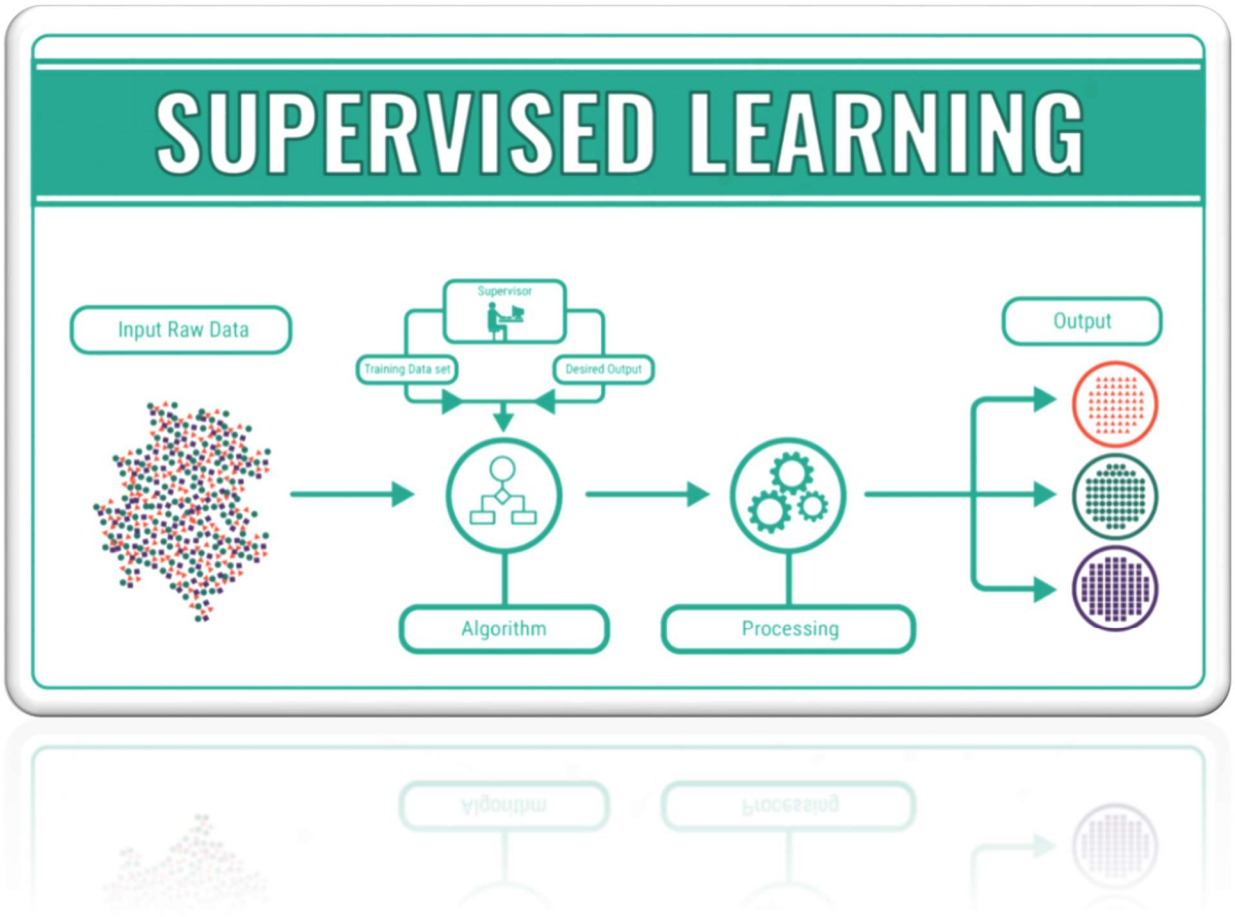


*L*ogistic Sigmoid Activation Function



Supervised Learning

Supervised learning uses a set of paired inputs and desired outputs. The learning task is to produce the desired output for each input. In this case the cost function is related to eliminating incorrect deductions. A commonly used cost is the mean-squared error, which tries to minimize the average squared error between the network's output and the desired output. Tasks suited for supervised learning are pattern recognition (also known as classification) and regression (also known as function approximation). Supervised learning is also applicable to sequential data (e.g., for hand writing, speech and gesture recognition). This can be thought of as learning with a "teacher", in the form of a function that provides continuous feedback on the quality of solutions obtained thus far.



Why isn't logistic Regression called Logistic Classification?

*The question means that you associate the word "**regression**" only with continuous outcomes, whereas in truth it **can be used with respect to both continuous and categorical outcomes**.*

The first reason for the confusion is because the great-granddaddy of regression techniques could only be applied to continuous outcomes. This was linear regression, originally developed by Karl Pearson for simple problems in 1908 and Sir Ronald Aylmer Fisher for multivariate problems in 1922. It was only in the 1950s that linear programming could be used to solve regression equations, including classification, and the 1980s when

computers were powerful enough to handle logistic regression. Prior to the 1950s the word 'regression' was fairly when entrenched for continuous problems, and nobody was bothering much with categorical problems—at least not to derive regression formulae.

Second, Leo Breiman, et al. wrote a book about recursive partitioning algorithms (automated decision trees), called Classification and Regression Trees (CART) where they proposed an approach applicable to both categorical and continuous variables. In my opinion, they used the word "regression" for continuous variables because it was commonly used and they could not think of an appropriate alternative (or wanted a sexy sounded acronym—CACT is harsh and sounds too much like rude words). Hence, the end result was confusion for decades to come, especially amongst the machine learning community where the term has been adopted.

*The word "**regress**" means to return to a more primitive state, and in modern statistics one speaks of "**regression towards the mean**". Well, modern means the past 100+ years. It was first proposed by Francis Galton when studying successive generations of sweet peas, and then applied the concept to humans (a believer in Eugenics). The idea was that offsprings' characteristics would be more like the broader population than the parents'.*

Both linear and logistic regression look for factors correlated with variations from the mean value or probability. Linear regression produces estimates for a continuous variable, and logistic regression the natural log of odds for a binary outcome which is basically a probability stated in a linear form. In both cases, the population mean is the baseline, and primary component of the intercept should it not be suppressed (which it should not be, unless one believes the true intercept is zero). One could also even use other techniques (e.g. linear programming), and as long as the goal is to identify factors associated with variations from the average it could be considered regression.

Personally, I wish these questions would stop and curse Mr. Breiman and his cohorts for their choice of terminology. The question is, what is then a short and easy alternative—classification and… what???? Almost all possible words that come to my mind could be applied to both continuous and categorical problems, and the dilemma can only be solved by using double-barrel terms (e.g. value- and category estimation). The only option really seems to be "continuous" instead of "regression", and a relabelling to CACT.

***Galton, Sir Francis (1877)**. 'Typical laws of heredity'. Paper presented to the weekly evening meeting of the Royal Institute, London. Volume VIII (66); **(1883)** INQUIRIES into HUMAN FACULTY and its DEVELOPMENT. J.M. Dent & Co: London and E.P. Dutton & Co.: New York; **(1888).** 'Co-relations and their Measurement, chiefly from Anthropometric Data'. Proceedings of the Royal Society. London Series, 45, 135-145; **(1889)** Natural Inheritance. Macmillan and Company: New York.*

***Breiman LM, Friedman JH, Stone CJ, Olshen RA (1984).** Classification and Regression Trees. Chapman and Hall, New York.*

Keras

Keras is compatible with: ***Python 2.7-3.6****.*

Keras is a high-level neural networks API, written in Python and capable of running on top of TensorFlow, CNTK, or Theano. It was developed with a focus on enabling fast experimentation. Being able to go from idea to result with the least possible delay is key to doing good research.

Why this name, Keras?

Keras (κέρας) means horn in Greek. It is a reference to a literary image from ancient Greek and Latin literature, first found in the Odyssey, where dream spirits (Oneiroi, singular Oneiros) are divided between those who deceive men with false visions, who arrive to Earth through a gate of ivory, and those who announce a future that will come to pass, who arrive through a gate of horn. It's a play on the words κέρας (horn) / κραίνω (fulfill), and ἐλέφας (ivory) / ἐλεφαίρομαι (deceive).

Keras was initially developed as part of the research effort of project ONEIROS (Open-ended Neuro-Electronic Intelligent Robot Operating System).

"Oneiroi are beyond our unravelling --who can be sure what tale they tell? Not all that men look for comes to pass. Two gates there are that give passage to fleeting Oneiroi; one is made of horn, one of ivory. The Oneiroi that pass through sawn ivory are deceitful, bearing a message that will not be fulfilled; those that come out through polished horn have truth behind them, to be accomplished for men who see them." Homer, Odyssey 19. 562 ff (Shewring translation).

Python Code's writing

I wrote the python code in Spyder (Pyhton 3.7).

1. *When I started to programming, firstly, I downloaded the cv2 and Keras libraries in my pc that I needed in a way that I noticed when I preliminary research.*

"conda install -c conda-forge keras tensorflow" for Keras Library

"python -m pip install opencv-python" for OpenCV3 Library

2. *After this process, I have put the data in a format that I can get the most smoothly. I divided into two folders, that names are "Training20x100" and "Test20x20".*
3. *I took them as an array, (they were 3-dimensional) (1st dimension; array, 2nd dimension numpy-array, 3rd dimension int) then I reduced the 3rd dimension to one dimension with the "reshape" method (for the Keras library).*
4. *I also used 2 arrays to tell me what my inputs are and the class names of my outputs. Then I made these sequences "one-hot encoding" with to_categorical method.*
5. *"cv2.imread()" I took my pictures / data with the method.*
6. *I converted my data from int to float.*
7. *I did normalize my data.*
8. *I created/designed/planned a model. The model has some layers.*
9. *Finally, I tried to train this modal.*

NOTES

- *Because I couldn't think in space, I couldn't edit my data lists as accepted by the Keras library, so it didn't work because the dimensions were incompatible, although everything was correct when the program runs it.*

References

- *https://towardsdatascience.com/logistic-regression-classifier-8583e0c3cf9*
- *https://machinelearningmastery.com/rectified-linear-activation-function-for-deep-learning-neural-networks/*
- *https://medium.com/turkce/keras-ile-derin-%C3%B6%C4%9Frenmeye-giri%C5%9F-40e13c249ea8*
- *https://github.com/keras-team/keras-applications*
- *https://pathmind.com/wiki/neural-network*
- *https://www.wikizeroo.org/index.php?q=aHR0cHM6Ly9lbi53aWtpcGVkaWEub3JnL3dpa2kvQXJ0aWZpY2lhbF9uZXVyYWxfbmV0d29yaw*
- *https://towardsdatascience.com/understanding-neural-networks-19020b758230*
- *https://datafloq.com/read/machine-learning-explained-understanding-learning/4478?source=post_page-----f1009cad907c----------*
- *https://www.quora.com/Why-isnt-Logistic-regression-called-Logistic-Classification*
- *https://keras.io/*
- *https://medium.com/turkce/keras-ile-derin-%C3%B6%C4%9Frenmeye-giri%C5%9F-40e13c249ea8*
- *https://github.com/ozgung/nn-tutorial/blob/master/notebooks/keras-tutorial.ipynb*
- http://aisdatasets.informatik.uni-freiburg.de/freiburg_groceries_dataset/