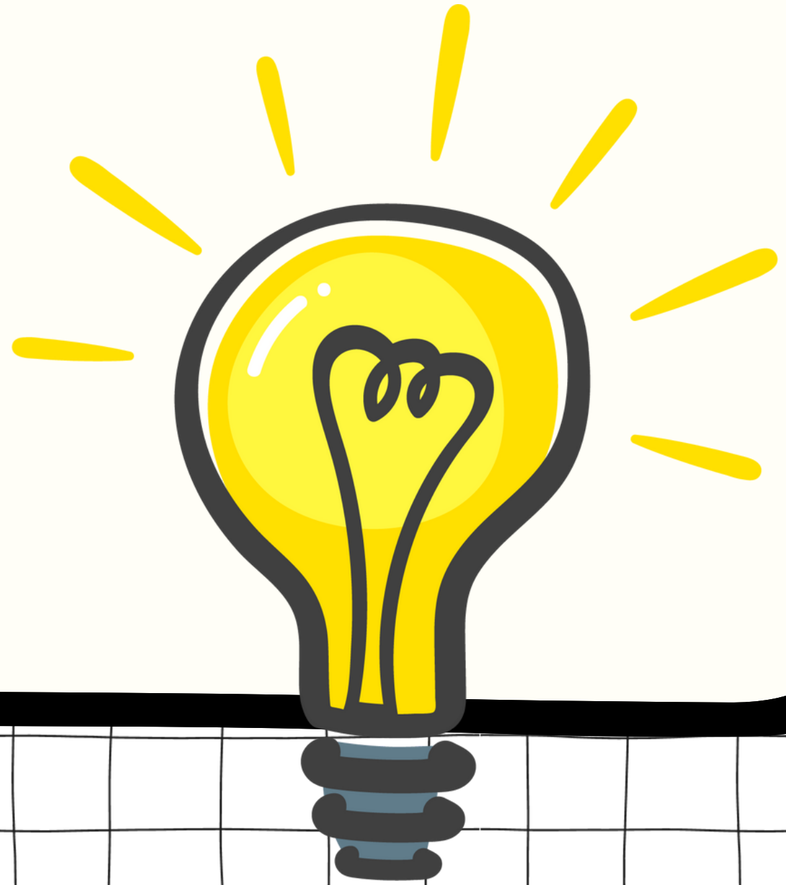
Handwriting Detection



Group: Coc Coc

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02 Dataset

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01

Introduction

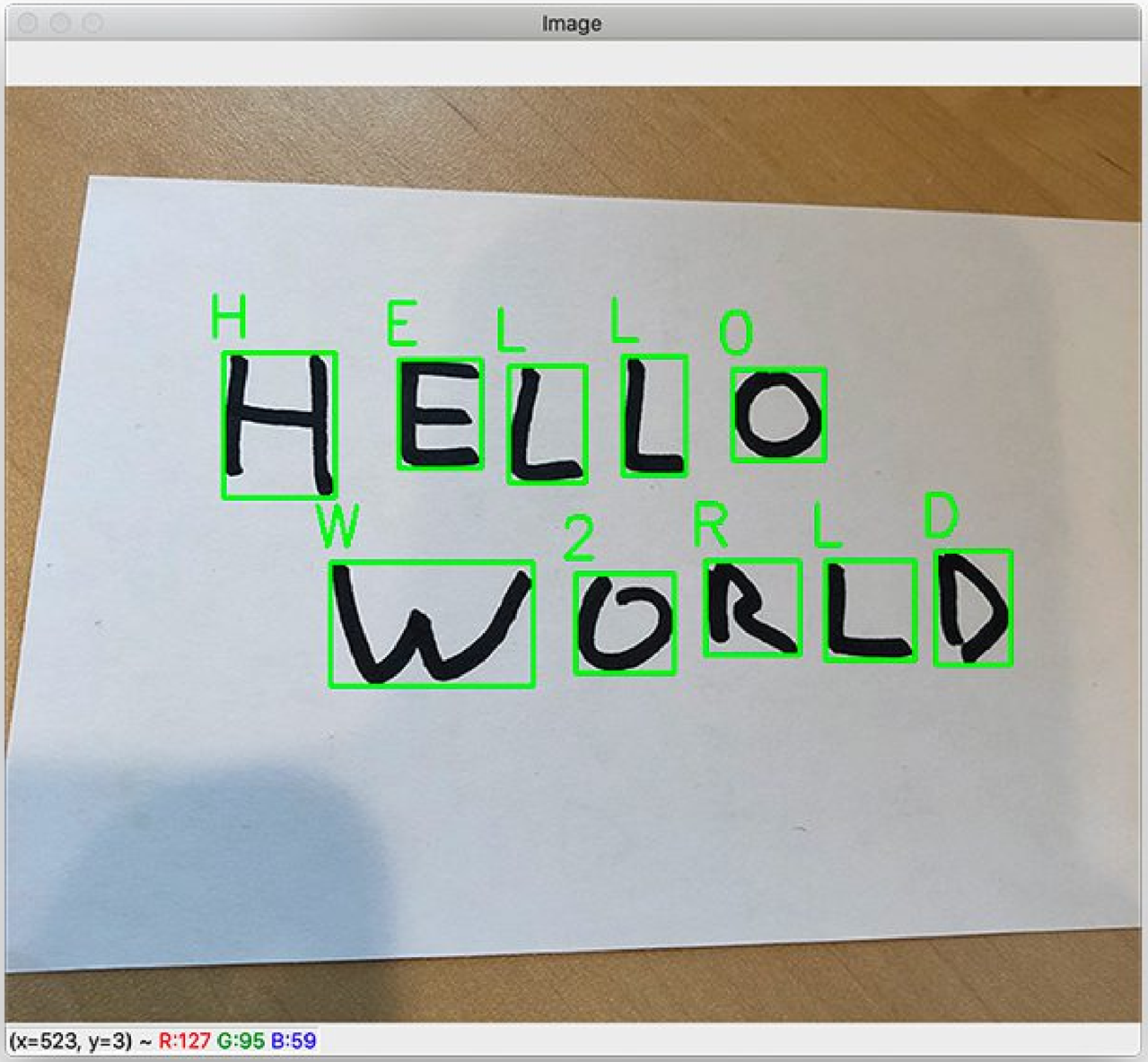
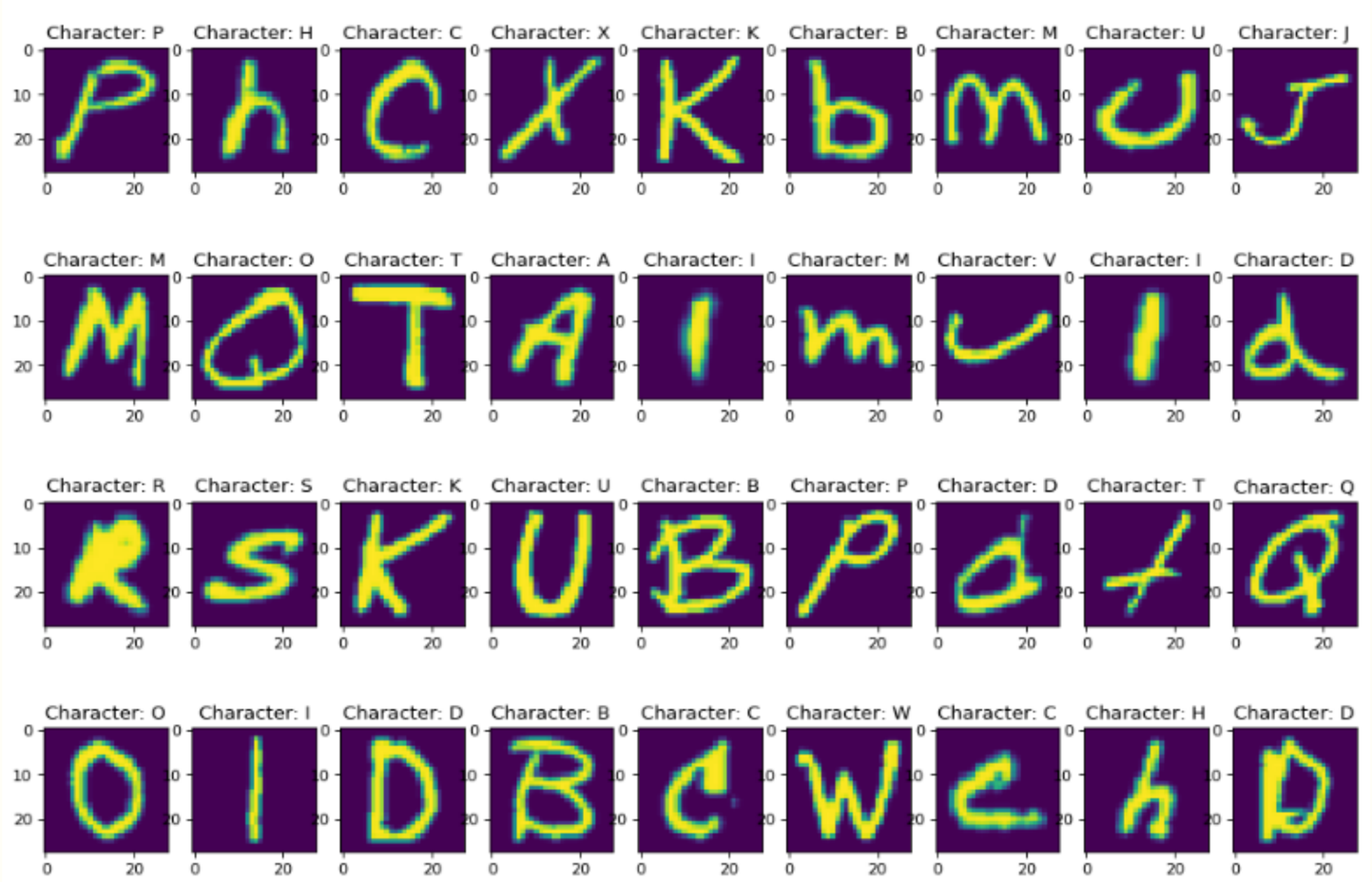


Image
H E L L O
HELLO
W 2 R L D
WORLD
(x=523, y=3) ~ R:127 G:95 B:59

02

Dataset

EMNIST


Character: P
Character: H
Character: C
Character: X
Character: K
Character: B
Character: M
Character: U
Character: J
Character: M
Character: O
Character: T
Character: A
Character: I
Character: M
Character: V
Character: I
Character: D
Character: R
Character: S
Character: K
Character: U
Character: B
Character: P
Character: D
Character: T
Character: Q
Character: O
Character: I
Character: D
Character: B
Character: C
Character: W
Character: C
Character: H
Character: D

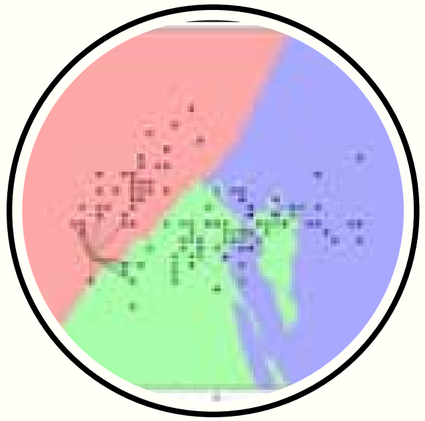
Handwritten Text Recognition (HTR)

Signature Verification

Captcha Solving

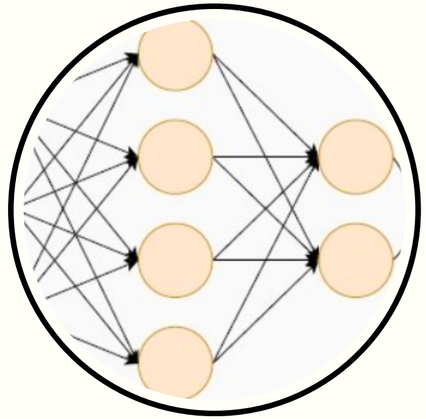
License Plate Recognition (LPR)

03
AI Models



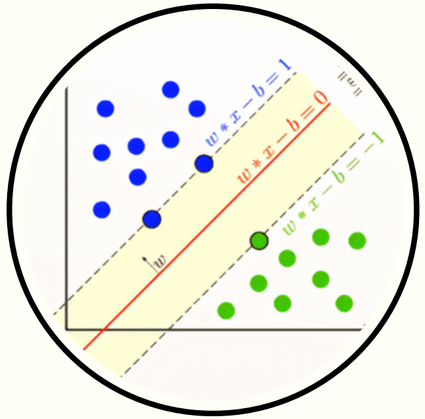
KNN

K-nearest neighbor



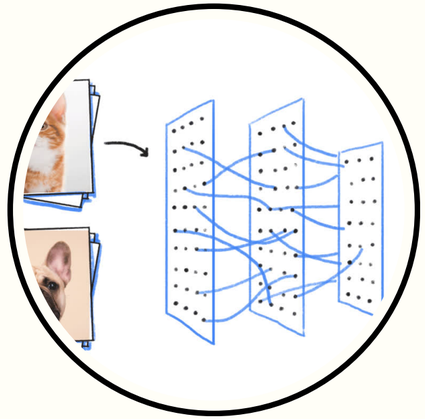
MLP

Multilayer Perceptron



SVM

Support vector machine



CNN

Convolutional neural network

K-nearest neighbor

01 Evelyn Fix and Joseph Hodges developed K-nearest neighbor(KNN) algorithm in 1951.

02 Thomas Cover later expanded on these ideas to develop the well-known kNN algorithm.

03 The objective of KNN algorithms is to classify the data point on how its neighbor is classified.

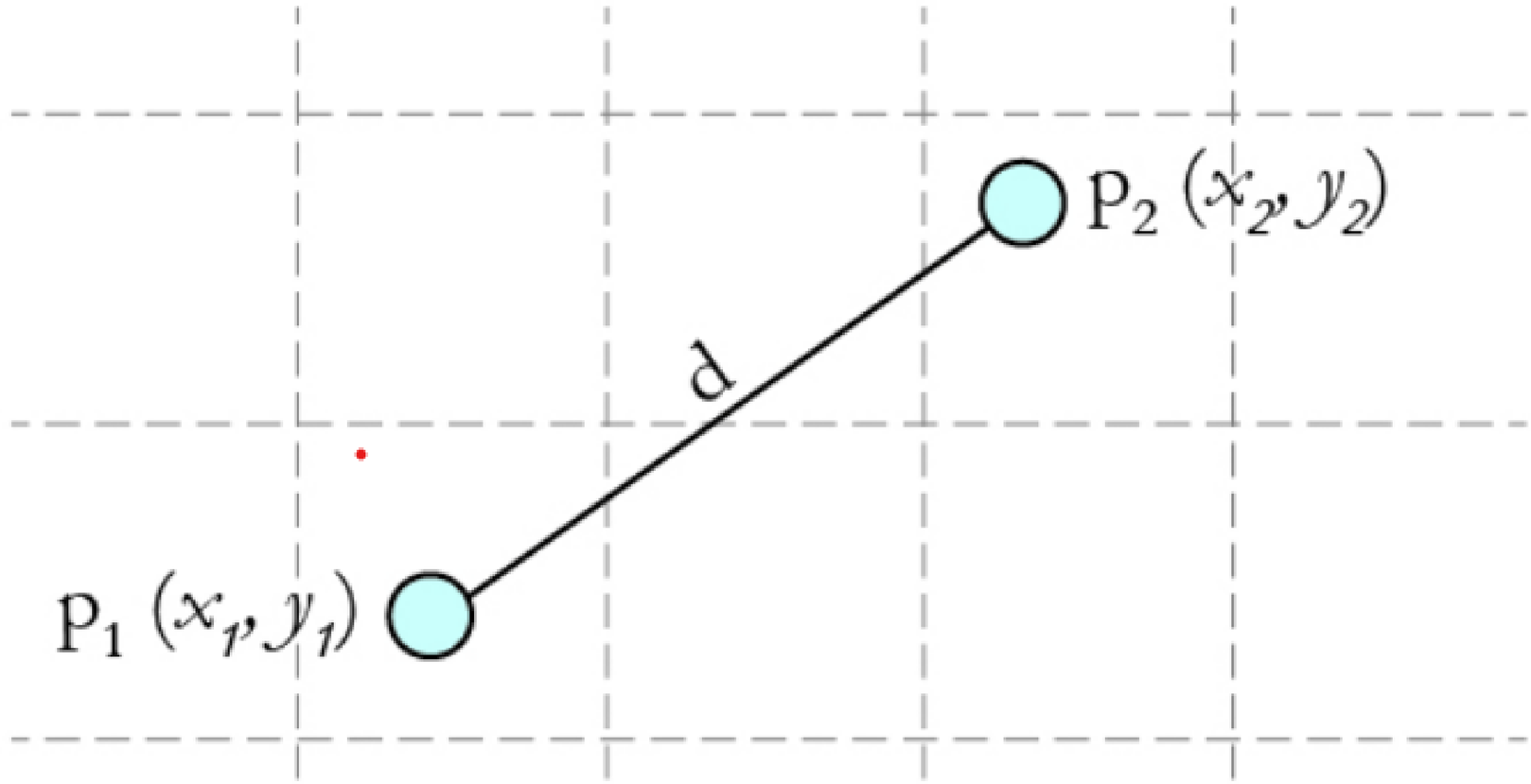
Evelyn Fix

Joshep Hodges

Thomas M. Cover

Fix, Evelyn; Hodges, Joseph L. (1951). Discriminatory Analysis. Nonparametric Discrimination: Consistency Properties (PDF) (Report). USAF School of Aviation Medicine, Randolph Field, Texas. Archived (PDF) from the original on September 26, 2020.
Cover, Thomas M.; Hart, Peter E. (1967). "Nearest neighbor pattern classification" (PDF). IEEE Transactions on Information Theory. 13 (1): 21–27. CiteSeerX 10.1.1.68.2616. doi:10.1109/TIT.1967.1053964. S2CID 5246200.

K-nearest Neighbor



$$\text{Euclidean distance (d)} = \sqrt{(x_2\text{-}x_1)^2 + (y_2\text{-}y_1)^2}$$

Multilayer Perceptron

01 The multilayer perceptron (MLP) was first introduced in the late 1950s and early 1960s by Frank Rosenblatt

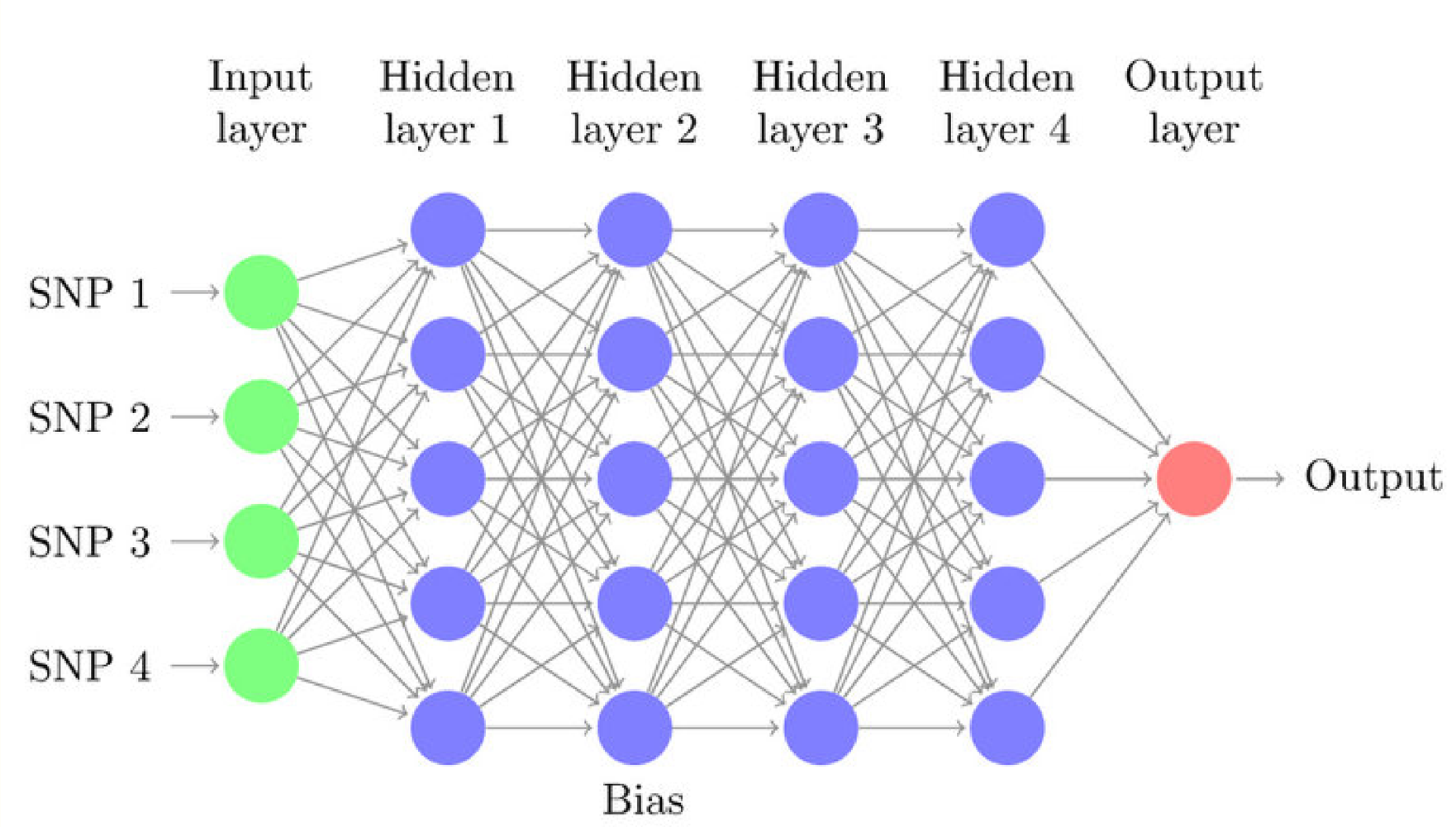
02 MLP was largely overshadowed by other neural network models, such as CNNs and RNNs.

03 Multilayer perceptron is a powerful modeling tool that can generate generalizable models by applying a supervised training procedure using examples of data with known outputs.

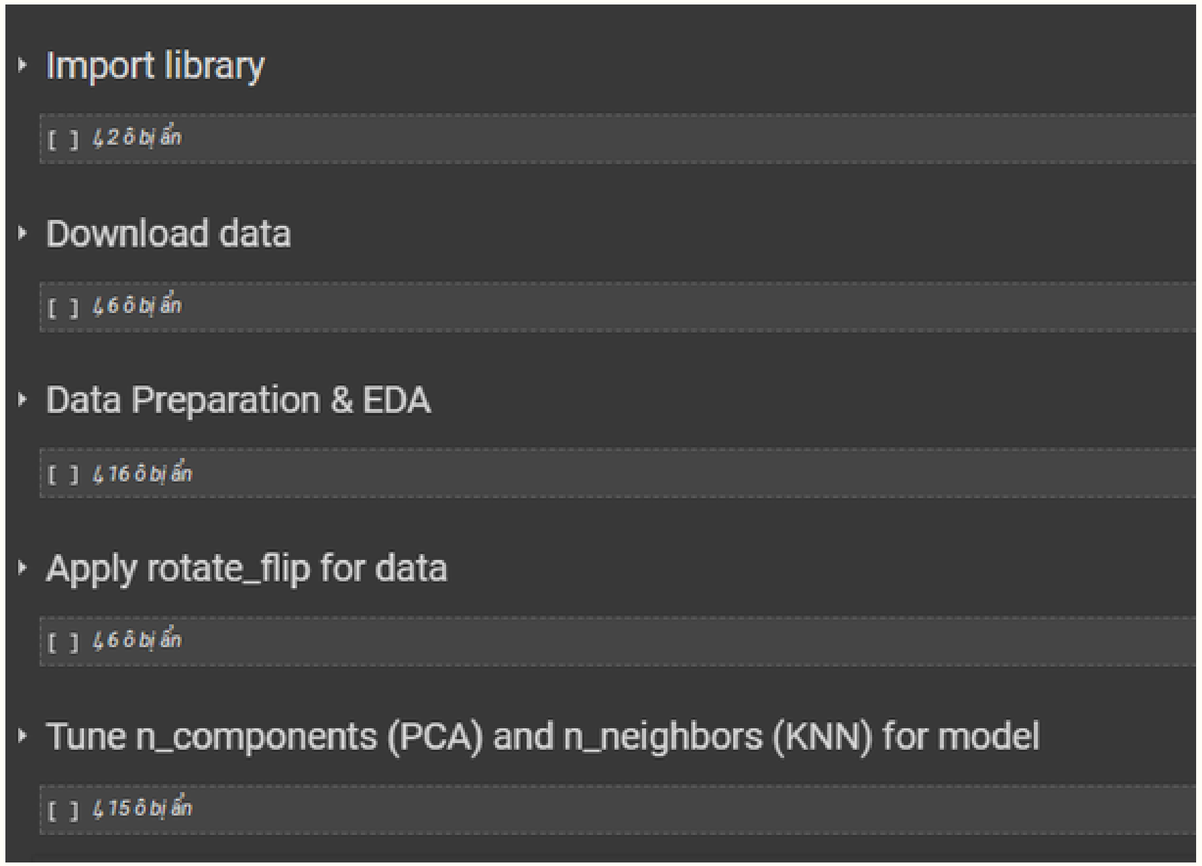
Frank Rosenblatt

Rosenblatt, F. (1958). The perceptron: a probabilistic model for information storage and organization in the brain. Psychological review, 65(6), 386.
Rumelhart, D. E., Hinton, G. E., & Williams, R. J. (1986). Learning representations by back-propagating errors. nature, 323(6088), 533-536.

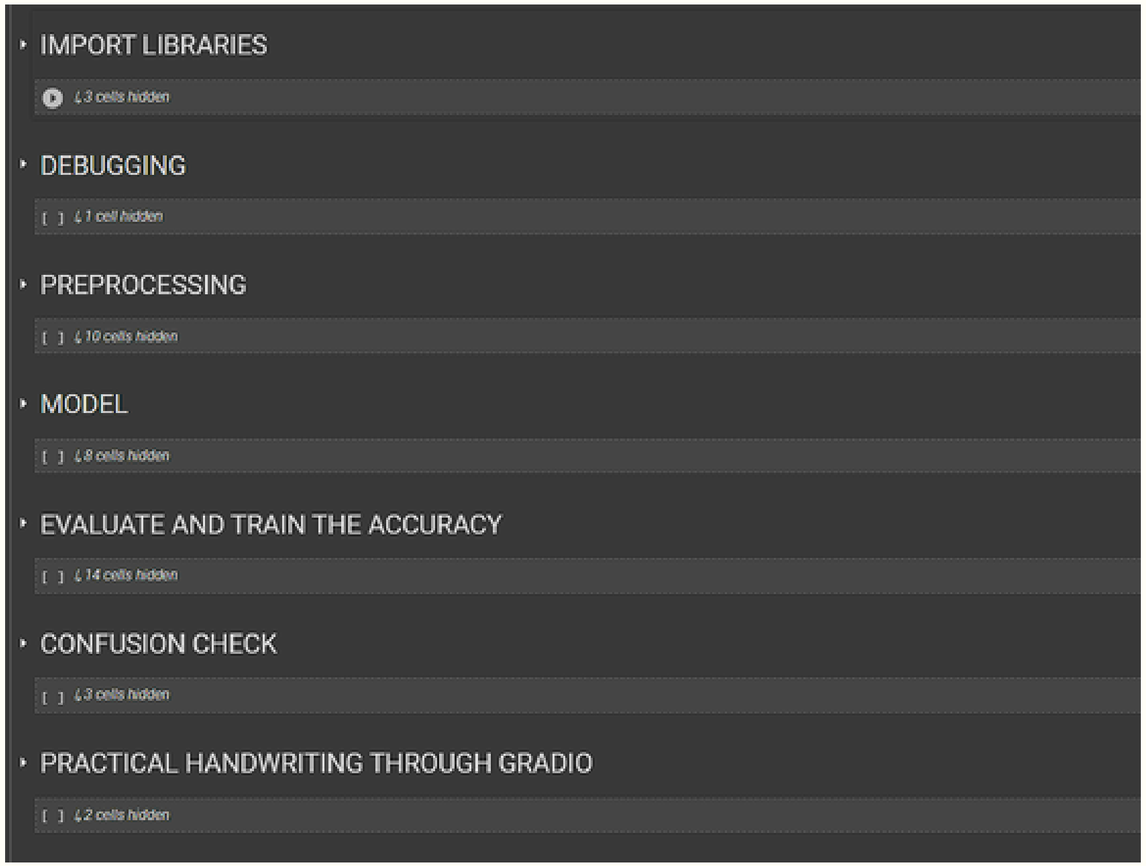
Multilayer Perceptron



K-nearest Neighbor



Multilayer Perceptron



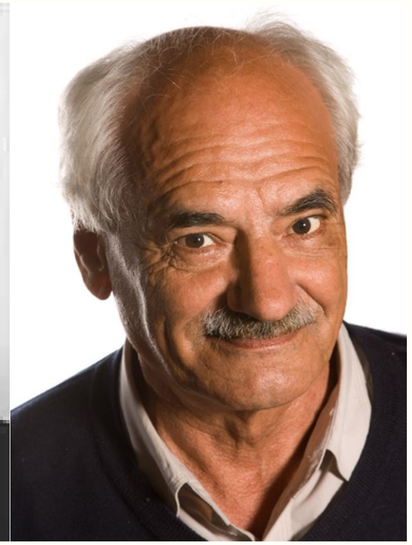
Support Vector Machine

01 Vladimir N. Vapnik is widely recognized as the primary inventor of SVMs. Alexey Ya. Chervonenkis also made significant contributions to the early development of SVMs

02 The concept of support vector machines (SVMs) originated in the 1960s with the work of Vladimir N. Vapnik and Alexey Ya. Chervonenkis.

03 SVMs offered a promising alternative by focusing on finding the optimal hyperplane that maximizes the margin between two classes of data points.

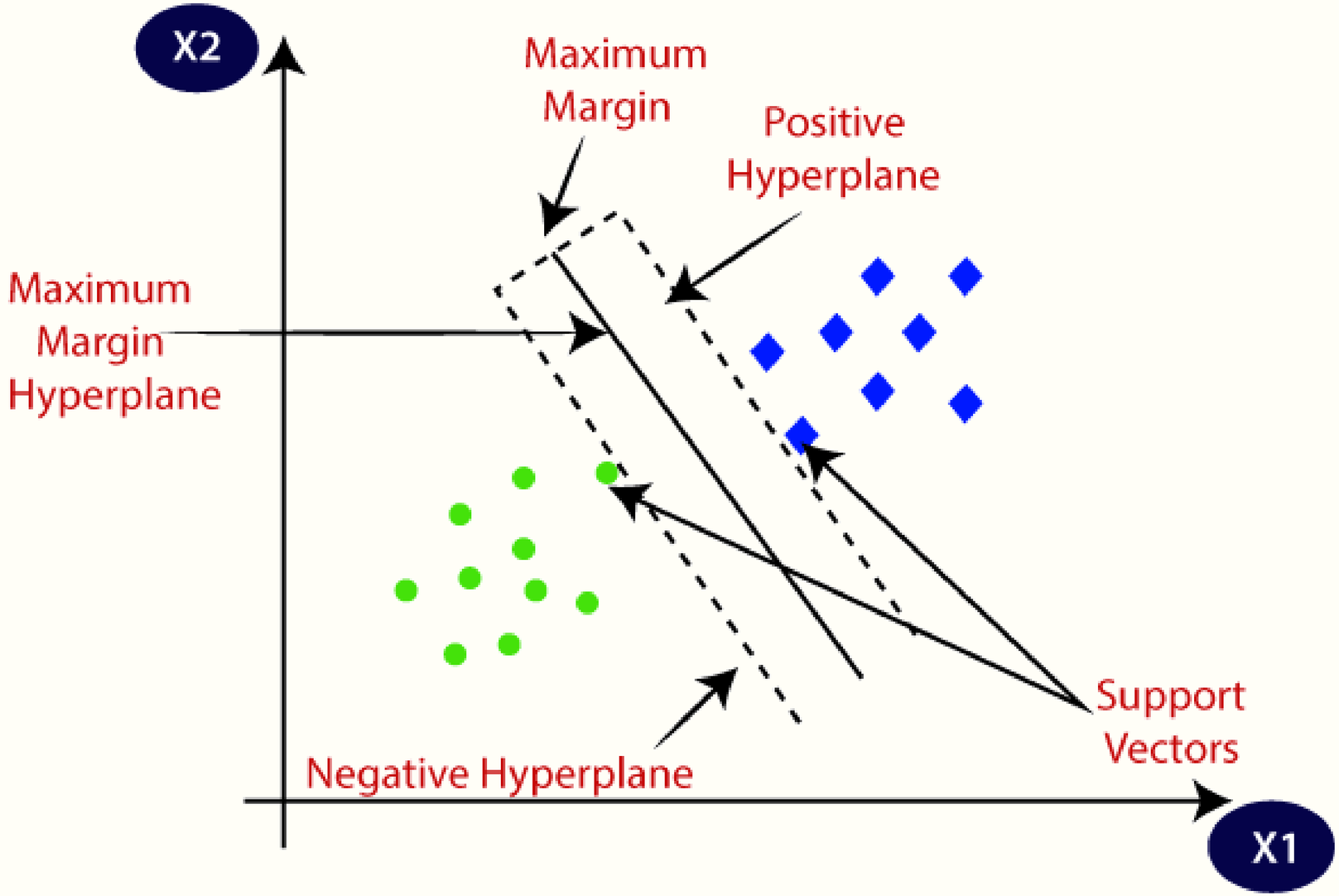
Vladimir N. Vapnik



Alexey Ya. Chervonenkis

Vapnik, V. N., & Chervonenkis, A. Y. (1964). A perceptron algorithm. Automation and Remote Control, 25(2), 288-290.
Boser, B. E., Guyon, I., & Vapnik, V. N. (1992). A training algorithm for optimal margin hyperplanes. IEEE Transactions on neural networks, 3(2), 229-239.
Cortes, C., & Vapnik, V. N. (1995). Support-vector networks. Machine learning, 20(3), 273-297.

Support Vector Machine



Convolutional Neural Networks

01 The concept of convolutional neural networks (CNNs) can be traced back to the late 20th century.

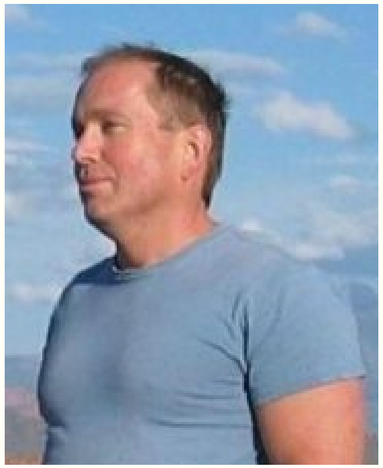
02 The modern form of CNNs was largely influenced by Yann LeCun, Léon Bottou, Yoshua Bengio, and Patrick Haffner in the 1990s

03 CNNs were initially developed for computer vision tasks, specifically image recognition and classification.

Yann LeCun

Léon Bottou

Yoshua Bengio

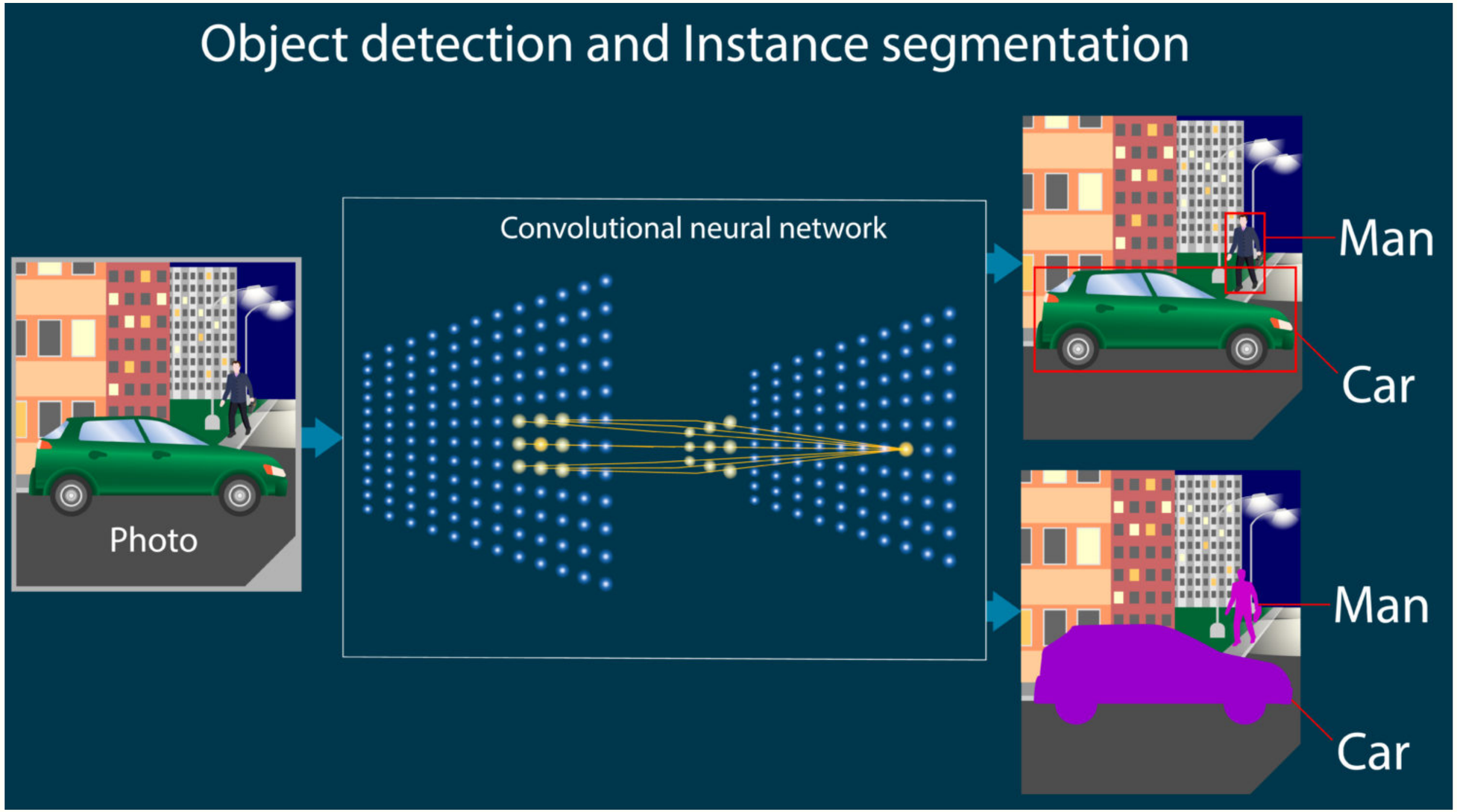


Patrick Haffner

Y. Le Cun et al., "Handwritten zip code recognition with multilayer networks," [1990] Proceedings. 10th International Conference on Pattern Recognition, Atlantic City, NJ, USA, 1990, pp. 35-40 vol.2, doi: 10.1109/ICPR.1990.119325.

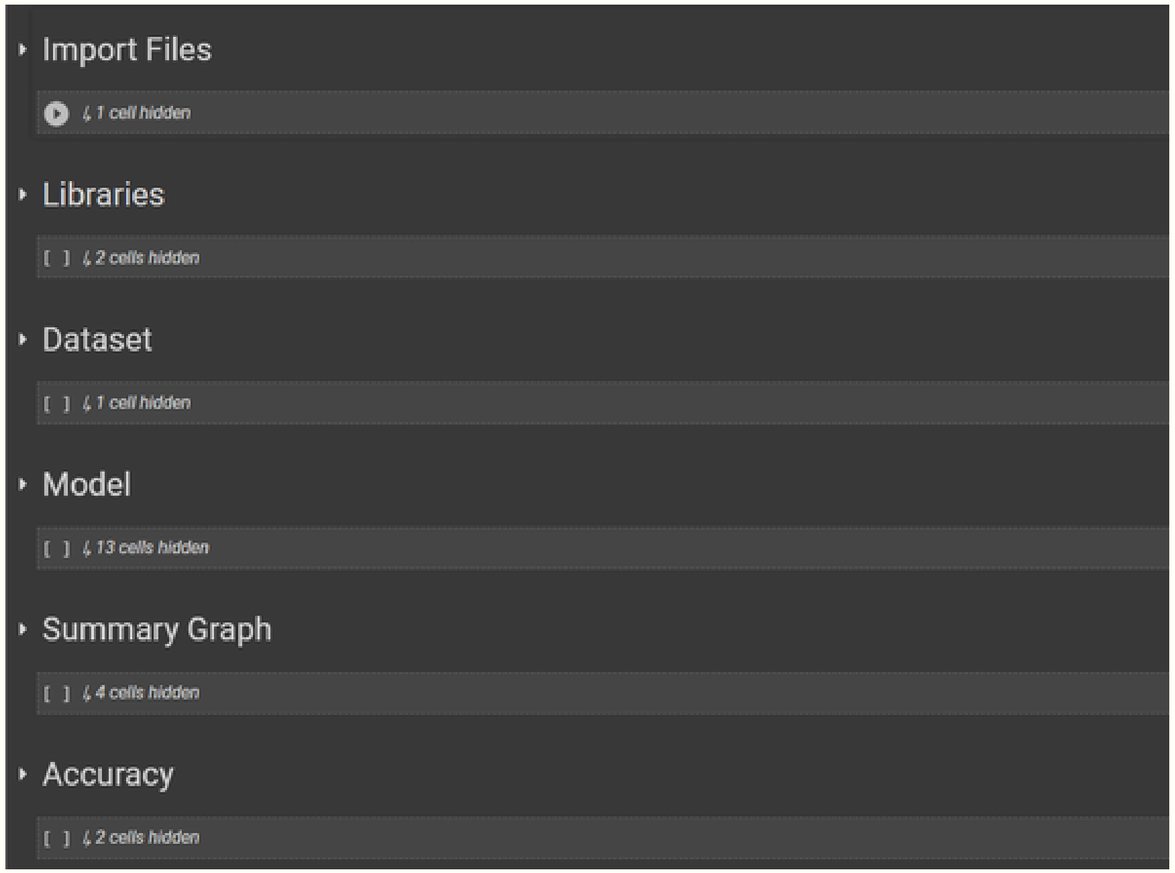
Yann Lecun, Léon Bottou, Yoshua Bengio, Patrick Haffner. Gradient-based learning applied to document recognition. Proceedings of the IEEE, 1998, 86 (11), pp.2278-2324. ff10.1109/5.726791ff. ffhal03926082

Convolutional Neural Networks



Convolutional Neural Networks

Support Vector Machine



04

Comparison

Performance

Model	Precision	Recall	Accuracy	F1 Score
KNN	0.8612	0.8561	0.8779	0.8565
CNN	0.9317	0.9315	0.8574	0.9312
SVM	0.9450	0.9327	0.8845	0.9207
MLP	0.8666	0.8628	0.8717	0.8630

KNN (k-nearest neighbors)	MLP (Multilayer Perceptron)	CNN (Convolutional Neural Network)	SVM (Support Vector Machine)
- Strengths: Simple and intuitive. - Limitations: expensive and memory-intensive. - Applications: small dataset sizes.	- Strengths: Versatile, applicable to various tasks. - Limitations: Overfitting, resource-intensive, hyperparameter-sensitive. - Applications: Suitable for both image and non-image.	- Strengths: Great for images, learns features. - Limitations: Data-intensive, slow, hard to interpret. - Applications: image recognition, captures spatial structure.	- Strengths: High-D effective, clear class separator. - Limitations: Data-hungry, hyperparameter-sensitive, noisy/overlapping class. - Applications: Letter recognition with distinct class.

05

Conclusion

Thank you for listening 🥰