KNN
ANN
MODELS

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G R O U P - 5

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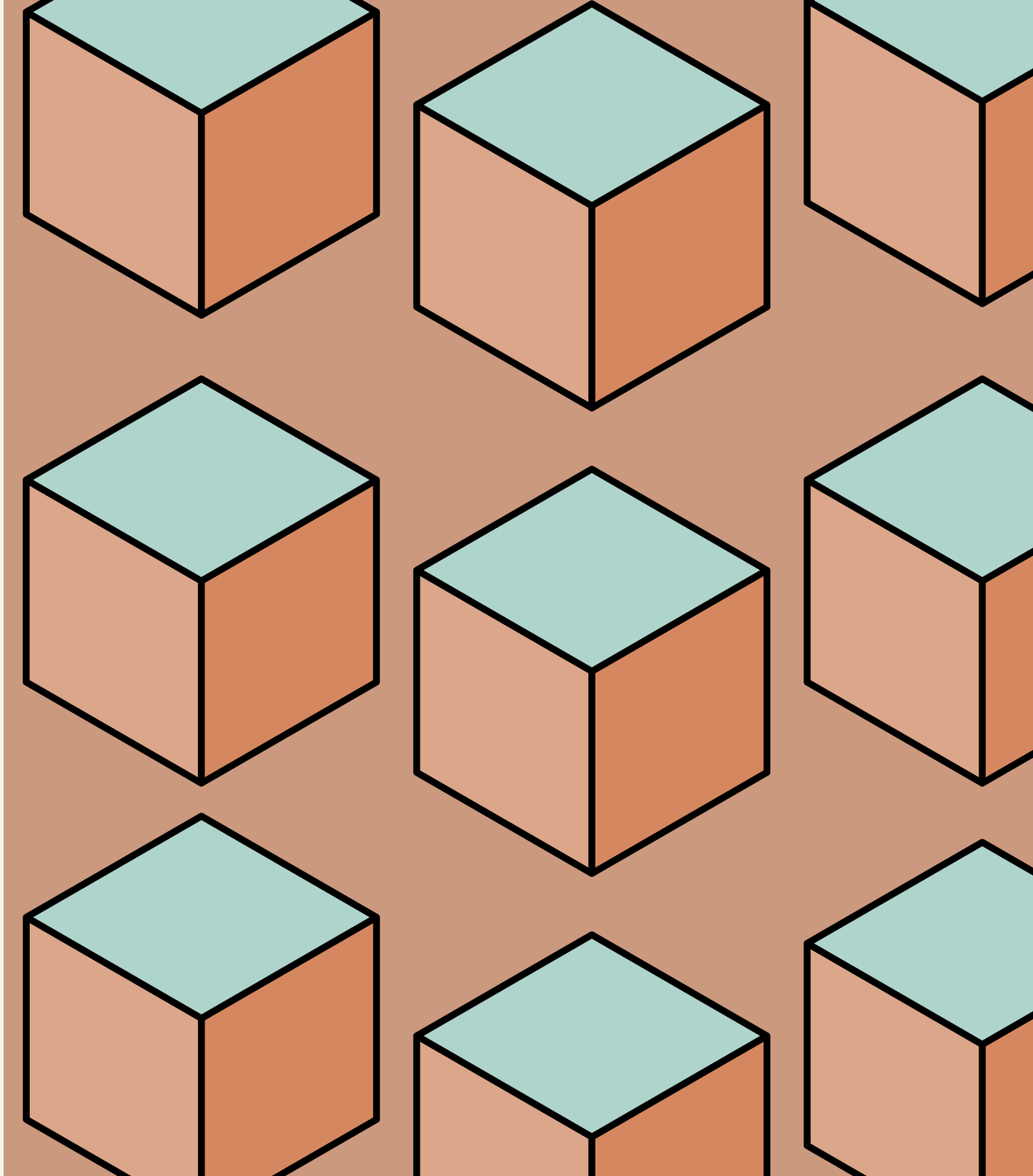

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INTRODUCTION

Welcome to the exciting world of Computer Vision!

Today, we'll be exploring two powerful techniques that have revolutionized the field: KNN and ANN.
But before we dive into the technical details, let me ask you a question.
Have you ever wondered how machines can learn from data and make predictions?
It may seem like science fiction, but it's real, and it's happening right now.

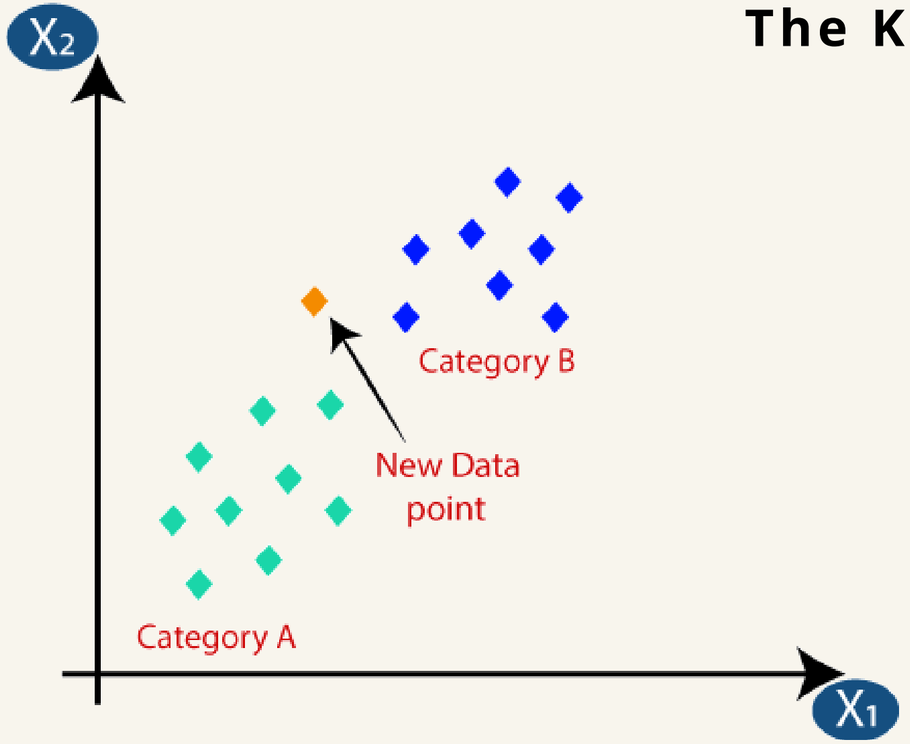
KNN and ANN are two of the most popular machine learning algorithms used today. They enable computers to recognize patterns, make decisions, and even generate new insights. From personalized recommendations on Amazon to self-driving cars, these algorithms are changing the way we live and work. So buckle up and get ready to explore the fascinating world of KNN and ANN!

WHAT IS KNN ?

- K-Nearest Neighbors, or KNN for short, is a machine learning algorithm used for classification and regression.
- The idea behind KNN is simple yet powerful: to predict the class of a new data point, we look at the K closest data points in the training set and take a majority vote.
- If K=1, then we simply assign the class of the nearest neighbor to our new data point.
- To determine the distance between two data points, KNN uses a distance metric such as Euclidean distance or Manhattan distance.
- Once we have computed the distances, we select the K nearest neighbors and use their class labels to make a prediction.
- In regression problems, we take the average of the K nearest neighbors' target values instead.

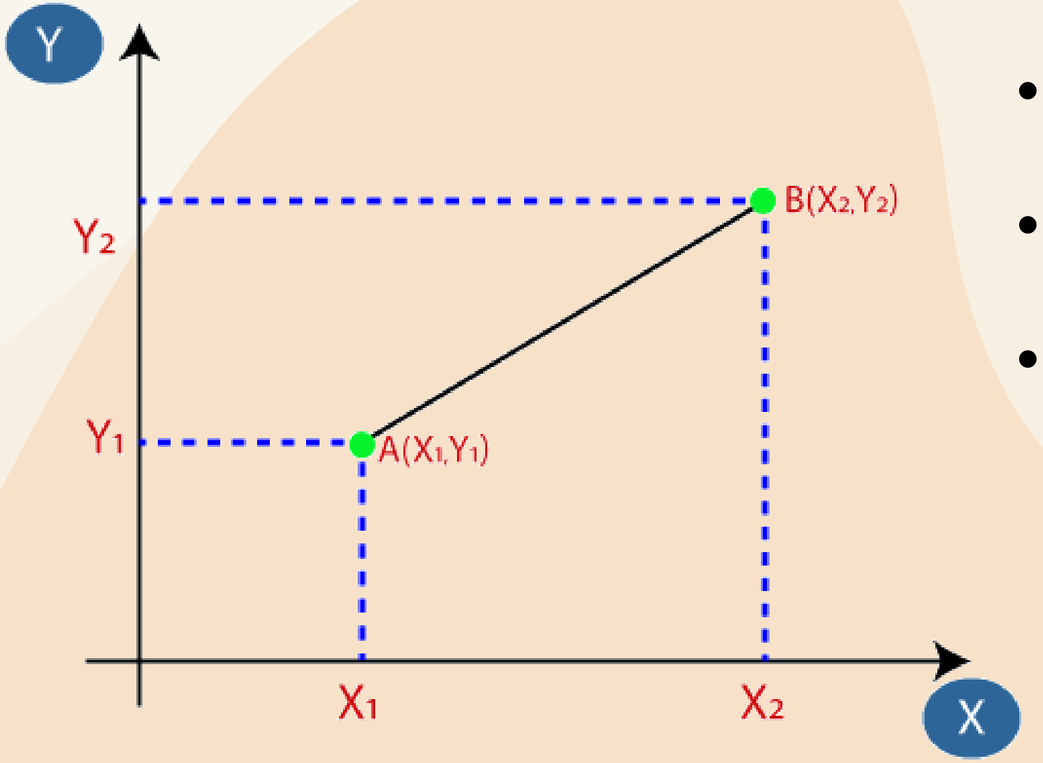
KNN IN ACTION

- **Suppose there are two categories, i.e., Category A and Category B, and we have a new data point x1, so this data point will lie in which of these categories.**
- **To solve this type of problem, we need a K-NN algorithm. With the help of K-NN, we can easily identify the category or class of a particular dataset**



The K-NN working can be explained on the basis of the below algorithm:

Step-1: Select the number K of the neighbors
Step-2: Calculate the Euclidean distance of K number of neighbors
Step-3: Take the K nearest neighbors as per the calculated Euclidean distance.
Step-4: Among these k neighbors, count the number of the data points in each category.
Step-5: Assign the new data points to that category for which the number of the neighbor is maximum.
Step-6: Our model is ready.

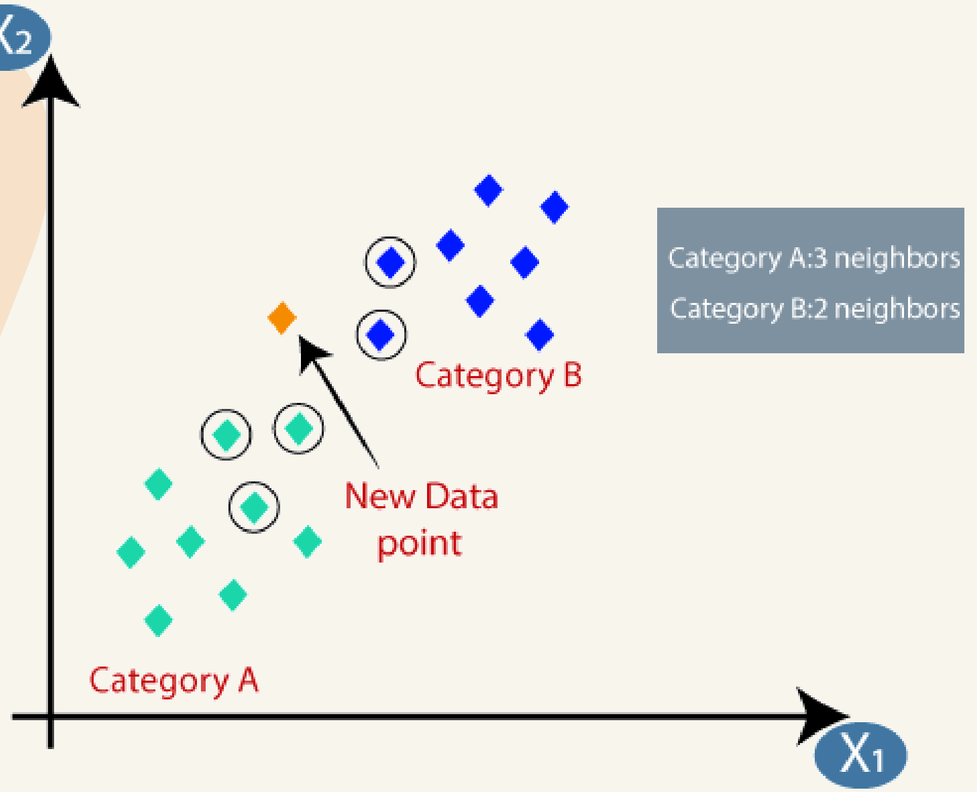


Euclidean Distance between A_1 and $B_2 = \sqrt{(X_2-X_1)^2+(Y_2-Y_1)^2}$

- Firstly, we will choose the number of neighbors, so we will choose the k=5.
- Next, we will calculate the Euclidean distance between the data points.
- The Euclidean distance is the distance between two points, which we have already studied in geometry. It can be calculated as:

- By calculating the Euclidean distance we got the nearest neighbors, as three nearest neighbors in category A and two nearest neighbors in category B. Consider the given image:

As we can see the 3 nearest neighbors are from category A, hence this new data point must belong to category A.



What is ANN

Artificial Neural Networks, or ANN, are a type of machine learning algorithm inspired by the structure and function of the human brain. Unlike K-Nearest Neighbors (KNN), which uses distance metrics to classify data points, ANN relies on a network of interconnected nodes that process input data through layers of mathematical functions.

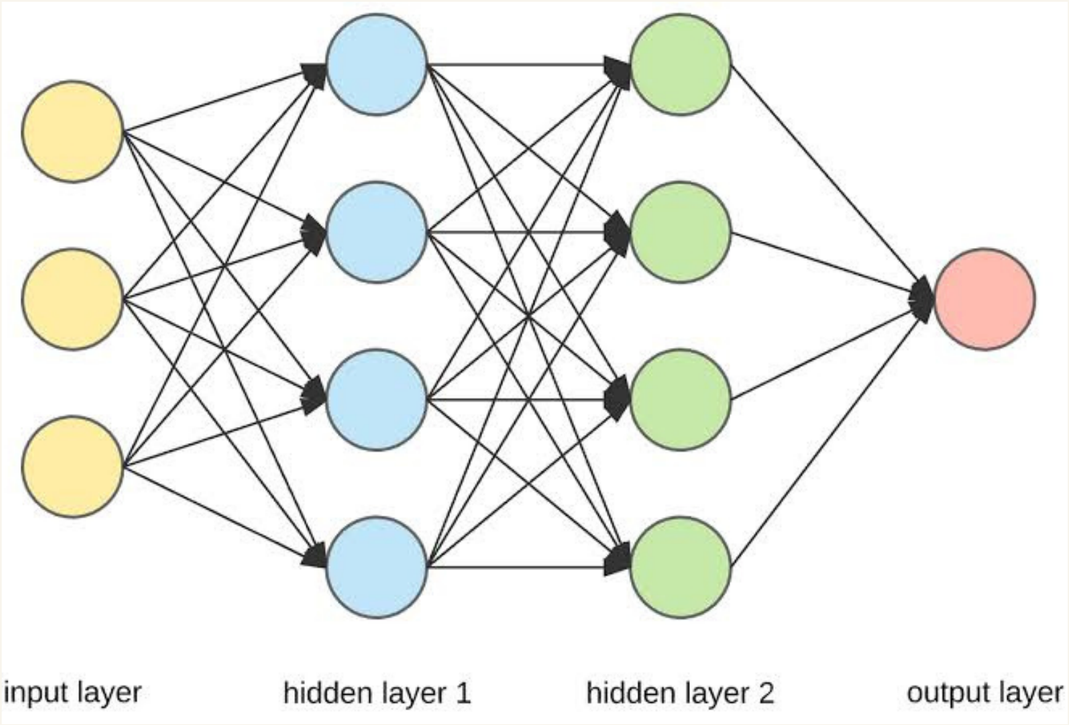
ANN can be used for a variety of tasks, including classification, regression, and clustering. It is particularly useful for complex problems with large amounts of data, as it can identify patterns and relationships that might not be apparent using other approaches. However, training an ANN can be time-consuming and requires a significant amount of computing power.

ANN Architecture

An artificial neural network (ANN) is composed of multiple layers, including an input layer, one or more hidden layers, and an output layer. The input layer receives data from the outside world, while the output layer produces the final result of the network's computation. The hidden layers perform intermediate computations that allow the network to learn complex patterns in the input data.

ANN Architecture

The architecture of an ANN can vary depending on the specific problem being solved. For example, a network designed to recognize handwritten digits might have several hidden layers, each with hundreds of neurons, while a network designed to predict stock prices might have only one or two hidden layers with fewer neurons. The number of neurons and layers in an ANN is determined by trial and error, as well as by the size and complexity of the input data.



Training an ANN

Artificial neural networks (ANNs) are trained using a process called backpropagation,
which involves adjusting the weights of the connections between neurons.
This process is based on the idea of minimizing the
difference between the actual output of the network and the desired output,
known as the error.
By iteratively adjusting the weights to reduce this error,
the network can learn to make accurate predictions or classifications.

Backpropagation works by propagating the error backwards through the network,
starting from the output layer and moving towards the input layer.
At each layer, the error is divided among the neurons based on their contribution to the output.
The weights of the connections are then adjusted
in proportion to the amount of error each neuron is responsible for.
This process is repeated until the error is minimized to an acceptable level.

ANN in Action

- One of the most exciting applications of ANN is in the field of computer vision.
- For example, an ANN can be trained to recognize objects in images or videos, enabling machines to perform tasks that were previously only possible for humans.
- This has huge implications for fields such as autonomous driving, where computers need to be able to identify and respond to their surroundings in real-time.
- Another area where ANN is making a big impact is in natural language processing.
- By training an ANN on large datasets of text, it is possible to build models that can understand and generate human language.
- This has led to breakthroughs in areas such as machine translation, sentiment analysis, and chatbots.

KNN vs. ANN

- KNN and ANN are two popular machine learning approaches, each with their own strengths and weaknesses.
- KNN is a simple yet powerful algorithm that relies on similarity measures to make predictions. It works well for small datasets but can be computationally expensive for larger ones.
- On the other hand, ANN is a more complex algorithm that uses multiple layers of neurons to learn patterns in data. It can handle large datasets but may require more training data than KNN.

Choosing the Right Approach

- Choosing between KNN and ANN can be a daunting task, but it ultimately depends on the problem you are trying to solve.
- KNN is best suited for problems that involve classification or clustering of data based on similarities, while ANN is ideal for problems that require complex pattern recognition or prediction.
- For example, if you are trying to predict stock prices based on historical data, ANN would be the better choice due to its ability to recognize patterns in large datasets.
- Another factor to consider is the size of your dataset. KNN works well with smaller datasets, but as the size of the dataset increases, the computational cost also increases. In contrast, ANN can handle larger datasets more efficiently due to its parallel processing capabilities.
- So if you are working with a large dataset, ANN may be the better choice.

CONCLUSION

- In conclusion, we have learned about two important machine learning approaches: KNN and ANN.
- KNN is a simple yet effective algorithm for classification and regression tasks, while ANN offers more flexibility and can handle complex problems with multiple inputs and outputs.
- Both approaches have their strengths and weaknesses, and choosing the right one depends on the specific problem at hand.

- As the field of machine learning continues to evolve, it is important to stay up-to-date with the latest developments and techniques.
- By understanding the fundamentals of KNN and ANN, you will be better equipped to tackle real-world problems and make meaningful contributions to the field.

THANK YOU!