Path Planning For Autonomous Navigation of UAV Using GPS Coordinates

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Abstract- *The use of neural networks has experienced significant growth in recent years due to their versatility, potential, and adaptability. In this context, a new approach for controlling catering robots' path planning is proposed using neural networks. The study evaluates various parameters such as training time, network performance, and predicted distance by applying the Probabilistic Roadmap (PRM) algorithm to obtain an optimal dataset. The results show that using neural networks can improve the forecasted distance by approximately 36% compared to traditional PRM. Additionally, a model of a topologically organized neural network with nonlinear analog neurons of the Hopfield type is presented as an effective way for path planning and obstacle avoidance. The model is based on an external input that activates a target neuron, which corresponds to the target position and considers obstacles in the topologically ordered neural map. The path is then obtained through the neural network dynamics and the neural activity gradient in the topologically ordered map. Both analytical and computer simulation results support the performance of the network.*

Keywords- Pathplanning; UAV; Neural Networks; GPS coordinates; CNN algorithm

I. INTRODUCTION

This project attempts to make it possible to safely navigate a virtual highway while sharing it with other vehicles at a manageable speed. A sparse map list of waypoints along the roadway and the localization and sensor fusion data from the automobile will be accessible. The vehicle must make every effort to maintain a speed of 20 MPH or less, overtaking slower moving vehicles when practicable, and avoiding crashes with other vehicles that may be changing lanes. Additionally, until changing lanes, the vehicle should not go inside defined traffic lanes. In order for autonomous cars to determine the quickest or most effective route between two places, path planning is a crucial component. The four main components of planning are route planning, prediction, behavioural planning, and path planning subsystem.

In order for autonomous mobile devices to reach their destination with the acceptance degree of accuracy, then must be able to plan to the route while detecting and avoiding obstacles along the way. Any mobile robotic system must be trustworthy and safe in order to do its job without endangering itself or others, making obstacle avoidance a critical ability.

The algorithm to enable superior obstacle avoidance, should be quick, reliable, and independent of previous environmental knowledge.

In our approach, the planner generates a large reference path signal but does not adjust the path due to a tracking error. The controller must keep track of the journey in a limited signal sense. Trajectories are propagated from predicted vehicle states at the node, with collision checks performed using the predicted trajectory, which can span several seconds. Although we addressed the case where the prediction error becomes large, it is still critical to keep the prediction error small to maintainacceptable performance.

II. METHODOLOGY

Description of the brain's neural connections: The human brain is composed of numerous neurons that are linked together in an intricate network. This network facilitates the transmission of information via a small electrical charge that passes on the source neuron to destination neuron. The strength of the connection between two neurons can vary, with stronger connections allowing for more charge flow. With frequent transmission, a pathway can become stronger over time.

Dataset and data cleaning: To analyze customer reviews for sentiment or emotion, an appropriate dataset is necessary. These datasets come in various formats, depending on the intended use. Raw data needs to be cleaned and pre-processed to ensure its suitability for downstream needs. Data cleaning involves correcting, repairing, or removing any incorrect or irrelevant data from the dataset.

Convolutional Neural Networks (CNN): In the field of artificial intelligence, computer vision aims to enable machines to perceive and analyze images and video like humans. CNN is a learning algorithm which assigns importance to different features or objects in an image, allowing it to differentiate between them. Unlike other classification algorithms, CNN requires minimal pre-processing as it can learn filters or characteristics over time. The architecture of CNN is similar to the neural connections from the man brain, drawing inspiration from it.

Pre-processing: To ensure that the input data is acceptable for the algorithm and can improve the model's accuracy and efficacy, pre-processing is done. To pre-process the dataset using MNB, the following steps are taken: [i] Eliminating missing values Initially, the observations containing missing values are removed. By removing incomplete observations, the data's overall quality for analysis is improved. [ii] Encoding values In general, the presence or absence of a word is encoded as a binary value, with 1 representing the word's presence and 0 representing its absence.

III. SYSTEM TOOLS

It is essentially a naive implementation of how our brains might work. Although it is not a particularly precise picture, it aims to imitate some of the strategies our brain use to learn from errors. Let's take a simplistic look at how human brains function before contrasting it with a neural network. In essence, the brain is made up of a vast network of neurons connecting to one another. Numerous neurons and connections are present. These neuron nodes communicate to themselves by exchanging a little electrical charge. Another essential aspect of these neural connections is their capacity to transition between strong and weak connections between two neurons.

More charge can go between them in a strong connection than in a weak one. A neuronal circuit that sends charge on a regular basis will ultimately become robust. Now asthe brain takes input from any external source, Let's assume we accidentally touch a hot pan. Our hands' nerves provide information to certain neurons in our brains. There is now a connection between these neurons and the ones that govern our hands. And under these circumstances, our brain has learnt that removing our hand from the pan as soon as possible is the wisest course of action. Because of this, there will be a strong connection between the neurons receiving information from the hand and the neurons regulating the hand.

IV. NEURAL NETWORKS

4.1. Introduction:

Deep learning techniques are based on neural networks, called artificial neural network. which are subsets of artificial neural networks. Their organization and nomenclature are patterned after the human brain, mimicking how biological neurons communicate.

For neural networks to grow and improve their accuracy over time, training data is necessary. However, These learning algorithms can quickly categorise and cluster data if their accuracy is improved, making them essential tools for artificial intelligence and computer science. Tasks in speech recognition or picture recognition can be done in minutes as opposed to hours when compared to manual identification by human experts.

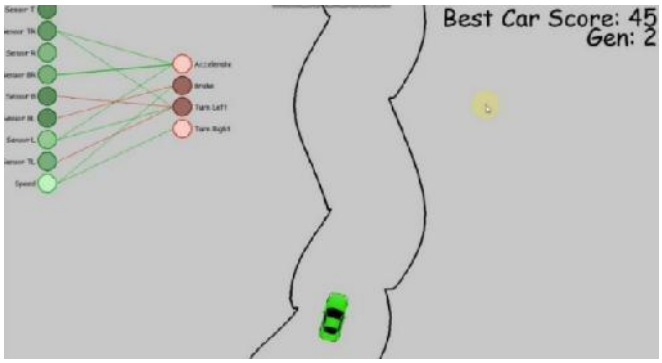

Fig4.1 : Neural Images

4.2 Convolutional Neural Network:

The ability of artificial intelligence to close the gap between human and computer skills has been growing dramatically. To get exceptional outcomes, both experts and novices concentrate on a variety of aspects of the subject. One of several of these disciplines is computer vision.

The goal of the field is to give machines the ability to perceive the world similarly to humans and to use that understanding for a variety of tasks, including image and video recognition, media recreation, recommendation systems,etc. With time, one algorithm—the convolutional neural network—has been developed and optimized, leading to breakthroughs in deep learning for computer vision.

A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning technique that can take in an input image, assign distinct objects and elements value (learnable weights and biases), and discriminate between them. In comparison to

other classification methods, a ConvNet requires significantly less pre-processing.

ConvNets can learn these filters/characteristics with adequate training, but with primitive approaches, filters are hand-engineered.ConvNets' design, which was influenced by the way the sensible Cortex is placed, is comparable to the connection pattern of neurons in the man mind. Only in this constrained area of the visual field, known as the Receptive Field, do individual neurons react to stimuli. The whole visual field is covered by a series of such fields that overlap.

4.3Input Images:

Three distinct color planes have been created from the red, green, and blue combination picture in the illustration. Images can be in a variety of color spaces, including HSV, RGB, grayscale, and more. Once the photos reach a size like 8K (76804320), you can imagine how computational demanding things would grow. ConvNet's job is to simplify the pictures without sacrificing any of the elements that are essential for making accurate predictions. This is crucial for creating an architecture that is both scalable to large datasets and effective at learning-features.

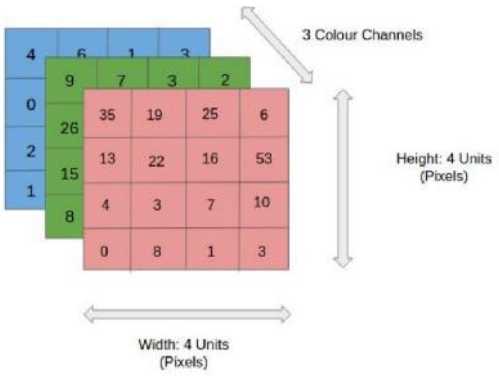

Fig 4.2 Input Images

4.4 Convolutional Layer:

In the field of artificial intelligence, computer vision aims able machineries to perceive and analyze images and video like humans. CNN is a deep learning algorithm that assigns importance to different features or objects in an image, allowing it to differentiate between them. Unlike other classification algorithms, CNN requires minimal pre-processing as it can learn filters or characteristics over time. CNN's architecture takes inspiration from the neural connections in the human brain and is modelled after them.

4.5 Stride Pixel:

The number of pixels that have been shifted across the input matrix is the stride. The filters are shifted one pixel at a time when the stride is 1. The filters are moved 1 pixel at a time when the stride is 2. With a stride of two, convolution would behave as shown in the figure.

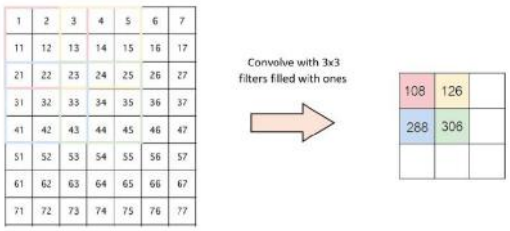

Fig 4.3: Stride Pixels

V. CONCLUSION

Since recurrent networks are often not used for path generating, neural networks have been used for path planning. While few applications exist, there is growing interest in utilizing neural networks for trajectory generation. The proposed methodology is an intelligent approach due to the network's memory layer, which aids in reducing errors. High efficiency can be achieved if the neural network is trained in multiple distinct environments rather than only in similar ones, as done in this study. The rapid production of output is also a notable advantage. Future work can focus on reducing the failure rate. It's vital to remember that the suggested approach only works well in the context in which it was trained. In contrast to other networks, it may be used to address problems in complex and dynamic situations. Fast path planning may be done using this technique. during rescue operations by robots with camera interfaces that can process images, such as drones. It is particularly effective and practical for mobile robotic systems that can be pre-programmed and autonomous.

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