Self-Driving car

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1 author:

Tesfamichael Molla
Wolkite University
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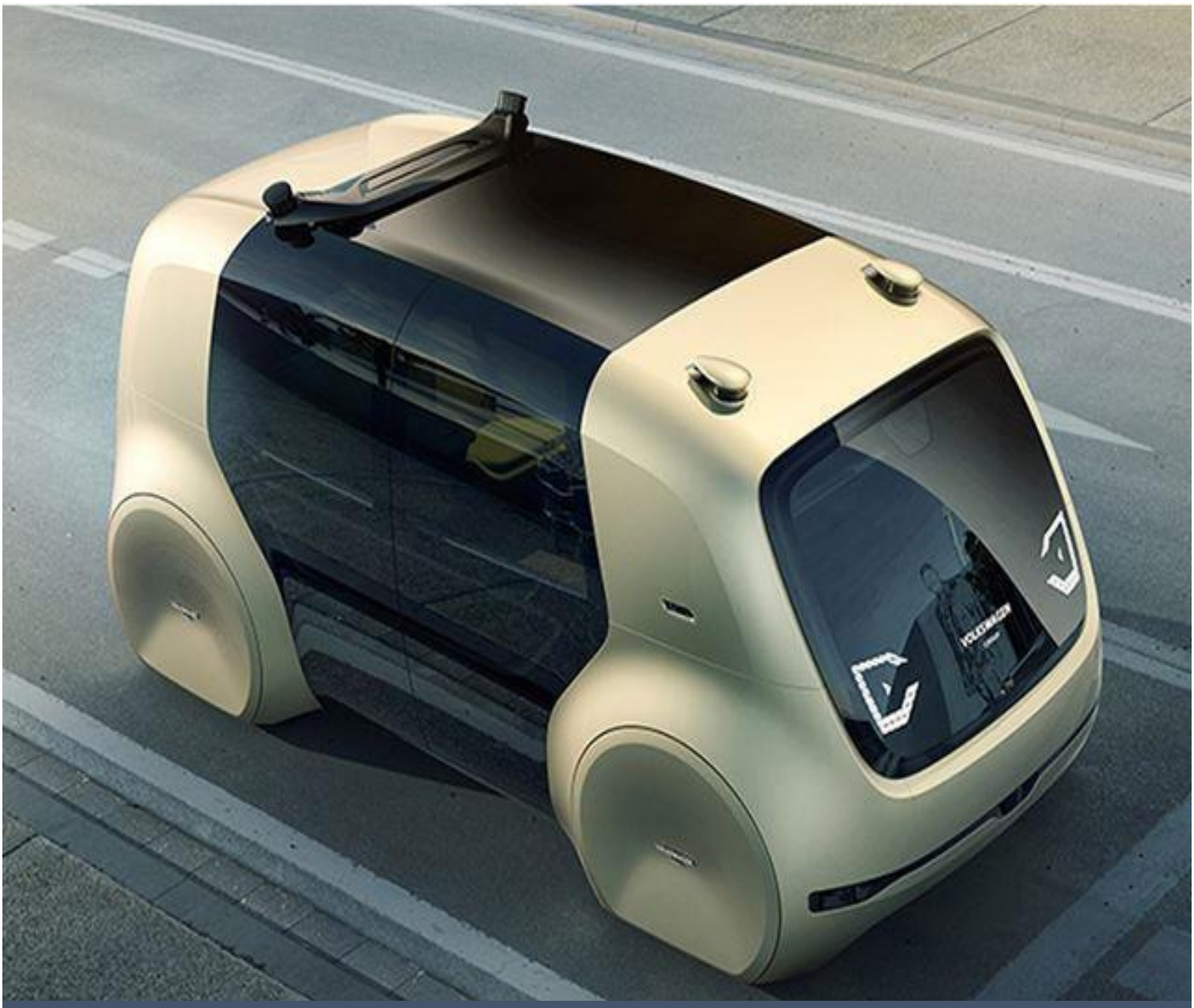

Self-Driving car

By – Tesfamichael Molla

Abstract

Self-driving is a vague term with a vague meaning as explained by tech emergence magazine. Experiments have been conducting on automating driving since ate list the 1920s [1]. There are five levels of automation in current self-driving cars with their own degree of automation [2]. In this paper I am proposing level 4 automation, which is a car that can drive itself almost all the time without any human input, but might be programmed not to drive in unmapped areas or during severe weather. The system has three stages. The first stage will be receiving data from videos and sensors, followed by a preprocessing section which applies CNN and Object detection mechanism on the images and finally there is a classification model for predicting steering angle, acceleration and direction. Performance will be tasted on various model attributes and conditions and will be presented in graphical interface.

1 Self-driving cars

A self-driving car, also known as a robot car, autonomous car, or driverless car, is a vehicle that is capable of sensing its environment and moving with little or no human input [3]. Autonomous cars combine a variety of sensors to perceive their surroundings, such as radar, computer, Vision, Lidar, Sonar, GPS, odometery and inertial measurement units. Advanced control systems interpret sensory information to identify appropriate navigation paths, as well as obstacles and relevant signage [4] [5]. Potential benefits include reduced costs, increased safety, increased mobility, increased customer satisfaction and reduced crime. Safety benefits include a reduction in traffic collisions [6] [7], resulting injuries and related costs, including for insurance. Automated cars are predicted to increase traffic flow [8]; provide enhanced mobility for children, the elderly [9], disabled, and the poor; relieve travelers from driving and navigation chores; lower fuel consumption; significantly reduce needs for parking space[10]; reduce crime [11]; and facilitate business models for transportation as a service, especially via the sharing economy [12] [13]. Problems include safety [14], technology, liability[15] [16], desire by individuals to control their cars[17], legal framework and government regulations; risk of loss of privacy and security concerns, such as hackers or terrorism; concern about the resulting loss of driving-related jobs in the road transport industry; and risk of increased suburbanization as travel becomes more convenient.

2 Object detection algorithm

This part of the system will detect pedestrian, traffic signs and other obstacles that comes around the road. The algorithm uses haar cascade files to detect objects in a given images. Haar cascade file are digital image features used in object detection. They owe their name to their intuitive similarity with Haar wavelets and were used in the first real time face detector. The system I am proposing will use 1 haar cascade file for one object. The output of the detection is going to be fed to the next stage which is the CNN (Convolutional Neural Network).

3 CNN

In deep-learning, a convolutional neural network is a class of deep, feed-forward artificial neural networks, most commonly applied to analyzing visual imagery. CNNs use a variation of multilayer perceptron designed to require minimal preprocessing.[1] They are also known as shift invariant or space invariant

artificial neural networks (SIANN), based on their shared-weights architecture and translation invariance characteristics.[2][3]

A CNN consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of convolutional layers, pooling layers, fully connected layers and normalization layers. Description of the process as a convolution in neural networks is by convention. Mathematically it is a cross-correlation rather than a convolution. This only has significance for the indices in the matrix, and thus which weights are placed at which index.

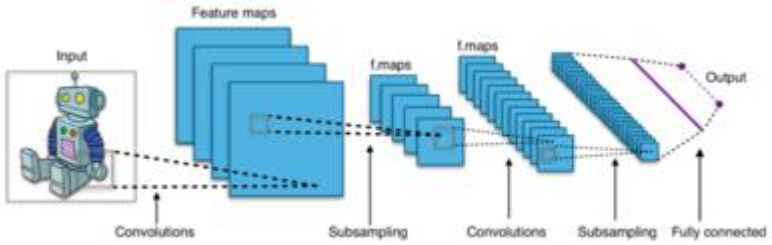

Fig [1] Typical CNN Model [18]

In my system I am going to use three CNN models, one for predicting the speed of the car, another for steering wheel angle and one for predicting the direction of the car.

After the decision is made by those CNN architectures the out is applied on the car and process the second frame. In our system, performance speed is going to be my main concern, because accuracy can be improved by feeding more data.

4 Scope

The final goal of the research is to build robot that can plough any given farm by learning the environment without any human intervention, but this project only emphasis on enabling the robot to learn environments and mange itself.

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