

Report on AI in Autonomous Vehicles

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Abstract—

I. INTRODUCTION

The technology in automobile industry has made some remarkable progress the last century. They have managed to make safe, reliable and affordable vehicles. The last couple of decades have seen significant advancements in computation and communication technologies, and consequentially autonomous vehicles (AV) are now becoming a reality [?]. Several prototypes exist today. Among others, Volvo have started implementing autonomous trucks that deliver goods [?].

A. Autonomous vehicles

1) *What is it?:* A definition of autonomous vehicle (AV) can be a vehicle which senses its environment with little or no human input or interaction. This means that the vehicle is capable of gathering information about the environment around it such as objects, temperature, position, velocity etc. And execute tasks or functions according to certain directives.

2) *Why?:* Humans are biological lifeforms which depend and react on, among other things but not limited to, sleep, food, stress, isolation, social interactions and other similar processes. Besides being complex lifeforms humans react differently to these processes choices taken, in certain situations, differ greatly.

Machines today are not dependent on such stimuli and therefore they can, theoretically, continue with tasks to an infinite amount of time. At mundane and repeated tasks such as arithmetic calculations or retaining huge amounts of data, machines and computers excel with unrivalled precision and accuracy. This makes them good candidates for making pure rational and logical decisions based on optimal outcomes of certain criteria.

Based on this assessment machines would take more optimal choices over time in comparison with the average human. And their choices would be easier to determine based on simulations and testing scenarios. This would make outcomes and outputs deterministic and easy to predict and consequentially present a good basis for development and optimization.

3) *Terms:*

II. THEORY

A. Technology

A brief presentation on certain technologies implemented in today's land-based vehicles. Both autonomous and non-autonomous.

1) *Real Time Operating System:* Cars today rely on numbers of sensors to acquire information about their surroundings. The velocity, GPS, proximity to obstacles, temperature etc. These sensors communicate to certain modules that is connected to an operating system (OS). This is often a specialized form of OS. A so-called Real Time Operating System (RTOS) makes up the central core and processor of the car. Within, all decisions based on data from the sensors are made and functions executed. Some aspects of RTOS are presented here.

a) *Hard time RTOS:* A deterministic RTOS. Meaning that the output of the RTOS should happen within a certain time or deadline. Used in mission-critical systems like medical devices, flight control space shuttles etcetera.

b) *Soft time RTOS:* Not as deterministic as Hard Time, but deadline of tasks and processes should be met within certain limits. The RTOS performance will degrade if tasks are never done within deadline and would be useless. Examples here can be audio-visual-systems for entertainment, games and general purpose OS's like Windows, Ubuntu and iOS.

2) *LIDAR:*

3) *GPS:*

B. Autonomy

C. Machine learning

Machine learning (ML) is a subset of artificial intelligence and by definition is "the study of computer algorithms that improve automatically through experience". These algorithms build a model based on huge amount of data, it is often separated into "training data" and "testing data". The ratio is often 70% "training data" and 30% "test data". Said in simpler terms it makes the machine/system learn from experience without being explicitly programmed. ML is often divided into three categories:

1) Supervised learning:

2) Unsupervised learning:

3) Reinforcement learning:

1) Deep learning:

D. Algorithms

1) Neural networks:

III. MAIN CONTENT

A. Which algorithms are used?

What kind of algorithm used is dependent on computational ability and determined on what kind of technology implemented within the AV. Be it GPS, LIDAR

IV. DISCUSSION

A. Safety

B. Implementation

C. GDPR

V. CONCLUSION