Applications of Artificial Intelligence in Smart Cars

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Abstract-**This study paper propounds the applications ofArtificial Intelligence in Smart Cars or Automatic Cars. As the name suggests Artificial Intelligence is the mannered form of human-made intelligence devices, network controlled robots or digitalized gadgets. Anything that performs automatically with the help of sensors or networks curates in a device to perform the task to assist the human and lessen the burden for them is known as Artificial Intelligence. In this modern time everything around us is related to Artificial Intelligence like Smart Phones (the fingerprint sensors, the face detections etc), Smart Televisions, Automatic cars and many more. Artificial Intelligence in Automatic cars is becoming high tech advanced machinery that can supersede the human from steering wheels. With the help of vast algorithms and machine learning, the automobile can overcome the difficult situations of roads.**

I. INTRODUCTION

Machines, particularly computer systems, use artificial intelligence to mimic human intelligence processes. Specific AI applications include intelligent machines, speech recognition, voice recognition, and machine vision.
As the A.I. boom grows, retailers have grumbled about needing to publicise how their services utilise A.I. What is commonly referred to as AI, including such machine learning, is typically just one component of AI. To design and train deep learning algorithms, AI requires specialized equipment. Although no one software program is relevant to AI, Programming languages, R, and Java are three notable examples.

In most cases, Large volumes of tagged training data are imported into AI systems., evaluating pattern-related analyzing pattern-related data and leveraging these patterns to anticipate future trends. A chat box given text conversation samples may learn to generate lifelike interactions by reviewing Whereas, a platform may begin to spot and interpret elements in photographs by viewing millions of them, a visual tool cannot. Reading, thinking, and self-preparation are the three cognitive capacities targeted by the AI program.Data gathering and the formulation of rules for transforming data into valuable information are the emphasis of this AI feature. Algorithms are a collection of rules that tell computer equipment how to do a task step by step.Procedures for Consultation: This AI feature concentrates on selecting the best strategy to get the intended result.Processing Procedures: The AI software's processing procedures are used to fine-tune the algorithms to make sure they produce the most reliable data possible

What arethe relevance of common sense?

AI is important because it may reveal previously inaccessible knowledge about a company's operationsand because AI can perform things better than humans in some circumstances. When it comes to tedious, time-consuming duties like reviewing big amounts of legal papers to verify that the correct fields are filled in, AI programmes execute job faster and with fewer errors.This has helped some large businesses increase their efficiency and given new commercial opportunities. Before the current AI wave, it would have been It's hard to envision employing computer software to link clients with taxis, yet Uber is one of the world's biggest companies performing so. It has the most powerful ml to forecast while customers will have to go in certain areas, allowing it to detect car drivers ahead of time. Google, for example, has employed learning algorithms to better analyse and optimise user behaviour across a variety of online services. Sundar Photosi, Google's CEO, declared in 2017 that now the business will function as just a "first AI" organization.Today's large and successful firms are utilising AI to improve their game and acquire a competitive advantage.

Insight into understanding, a senior lecturer of merged biology and engineering at Indiana University, divided AI into four categories, starting with commonplace smart work-based programmes and advancing to secure information that don't exist yet. The following are the categories:

• Sporting goods. The AI system does it specifics tasks without any memory. Take chess programme Deep Blue, where it defeated its opponent but it lacks storage, making it unable to forecast the future based on previous experience.

•Memory problems. These AI systems can use prior data to inform judgments in the future since they have memory. This is how some self-driving car decision-making algorithms are built.

• Theoretical psychology. The term "psychological theory" refers to psychology as a science. When it comes to artificial intelligence, this means the system would be able to notice emotions and conflicts. This AI will be able to comprehend and forecast human intents, which is an important talent of AI technologies to become important members of organisations.

•Self-observation. Ai technologies have a feeling of self at this point, which provides them with information. Machines are self-observed and awareof its current state. This kind of AI does not yet exist.

AI may be found in a variety of technologies. Six instanc are as follows:

• Whenever flexible tools are combined with Ai, the volume and variety of jobs completed may increase by default. RPA, for

examples, is a sort of technology that organizes the reproduction of data data processing based on frequently understood human notions. RPA can automate broad swaths of corporate processes when combined with deep learning and upcoming AI technologies, enabling RPA software bots to impart AI knowledge and adapt to procedure changes.

• Artificial intelligence. This is the ability to use a computer without having to programme it. In an essence, in-depth scanning is a sub - field of machine that is sometimes regarded as the gold standard for forecasting. Machine learning algorithms are divided into three categories:

While reading, I was supervised. Labeling data sets can help identify trends, and fresh sets of data can be labeled too.

(ii) Reading when alone. The data sets aren't categorised or organised by similarities or differences.

(iii) Improve your reading abilities. Even if the data sets aren't labeled, the AI system responds after a few activities or actions.

• Machine recognition. This technology allows the machine to see. Machine vision uses digital, digital audio converter, and digital logic to gather and analyse visual data. Spite of the fact that it is not restricted by biology and can be designed to appear on a number of surfaces, including walls, machine vision is frequently confused with human vision. It's used for many things, including recognition of signature and analysis of medical pictures. AI machine is combined with machine learning, while emphasizes on image processing based on machine.

•Analysis of NLP. It is a linguistic analysis that uses computers. Spam detection, which evaluates the topic and substance of a letter to decide if it is spam, is the earliest and well-known usage of NLP. ML is used in today's NLP approaches. Text translating, emotive evaluation, and recognition of speech like alexa.

• The machines. This technological area focused on the blueprint and construction of robotics, which are commonly use for doing tasks that humans find hard to complete. As example, NASA uses robots in conjunction with a vehicle assembly line to lift large objects into orbit. ML is being used to build robots that can communicate with people.

• Autonomous vehicles. Autonomous vehicles employ a combination of computer vision, image recognition, and deep learning to achieve automatic driving abilities while sitting on a set road and avoiding unanticipated barriers like pedestrians.

II. ELEMENTS OF ARTIFICIAL INTELLIGENCE

AI's most important components:

Natural Language Processing:

- Processing Natural Language is an artificial intelligence field that allows robots to understand and use human language in everyday scenarios. It's just software that can understand both written and spoken language.
- Automatic language translators used in multilingual conferences, text-to-speech, speech-to-text translation, and knowledge extraction from text all require processing natural language.
- Data in the form of raw language, such as handwriting, speech, and photographs, is scanned and converted into contextually relevant structures using this technique.
- The software's primary use is in virtual reality games like Starship Commander. NLP (natural language processing) gives the gamers exceptional feelings in this game, making them feel as if they are playing in a fascinating environment.
- Example: Alexa,googleetc..

Expert Systems:

- Expert systems are devices or software programmes that explain and offer information to users based on a set of rules established by an expert.
- They are program of computer that are designed to solve the complex problems.
- It is high in performance, understandable, reliable and highly responsive.
- Examples: Flight-tracking system, Clinical system.

Robotics:

- Robotics is aartificial intelligence machine that works like human intellectual combining of Electrical and Mechanical Engineering with design of Computer Science.
- Robotics are mechanical constructs of various kinds that have been designed to carry out certain tasks in response to human commands.
- Drones and rovers are terms that refer to how they utilise the environment (land, air, and water).
- The following are some of the advantages of using robots in the oil and gas industry: i. improving safety ii. increasing production iii. automating repetitive jobs iv. lowering operating expenses by reducing downtime.
- Intelligent Agents:

- Multi-agent systemis a branch of artificial intelligence that develops computer systems that can make decisions and execute actions on their own.
- An intelligent agent is a self-contained creature that can operate on its surroundings utilising sensors and actuators to achieve its objectives.
- Agents have been effectively used in a variety of industries, most notably manufacturing, and have shown to offer potential advantages in the petroleum business.
- Consider the thermostat as example.

Computational Intelligence:

Computational Intelligence is the statistical aspect of AI that focuses on utilising and deriving value from data.
It develops machine learning workflows from historical data and predicts future events using knowledge discovery and data mining processes.
It is critical in the creation of successful intelligent systems, such as games and cognitive developmental systems.

Nowadays, deep learning is the most popular artificial intelligence method. Computational intelligence is actually used in some of the most successful AI systems.

III. AUTOMATIC VEHICLE

An automated car has an AI transmission and does not require the driver must manually choose gears. Communications, often referred as gearboxes, control a vehicle's rotational force and speed.. As a result, automatic drive shifts gears as the vehicle's ratio changes. Sensors, actuators, complicated algorithms, machine learning, and deep software processors are used in automatic automobiles with Artificial Intelligence transmissions that use inner pressure to shift gears at the proper moment. The convertor is in charge of when the gearbox is briefly separated from the engine, shifting gears.

3.1 AUTOMATIC CAR HISTORY

In 1921, a Canadian steam engineer named Alfred Horner devised the automatic gearbox.. He designed the gearbox to use compressed gas instead of hydraulic fluid.
However, it lacked the necessary power and was never commercially available. GM (General Motors) created the first hydraulic fluid automatic transmission system in the late 1930s, which was released in 1940 as the "Hydramatic."
The 1948 Oldsmobile was the first car to include an automatic transmission. Earl Thompson, a GM engineer, created and popularised the Hydramatic as the most advanced technology since the self-starter. General Motors and Oldsmobile collaborated on the Hydramatic, which is essentially a transmission system. Throughout 1955, the Hydramatic was upgraded on a regular basis the original concept. In 1956, the Hydramatic was replaced with the "Jet-away." The Jet-away, sometimes known as the "Jet," was a failure and was quickly replaced in 1969 by the more successful Turbo Hydramatic.
The Hydramatic was one of the most successful vehicle inventions in history. Though it was not the first automatic gearbox to be introduced into the vehicle industry, it was the first commercial success that helped to propel automated transmission speculation forward.

3.2 AUTOMATIC AUTOMOBILE TYPES

1. Manual Transmission Automated (AMT)
The AI-generated Automatic Cars are ideal for individuals looking for a smart vehicle that is both efficient and cheap. An Automatic Manual Transmission (AMT) is a modified version of a manual gear box that uses sensors, actuators, servo motors, and programmes. All of these work together to mechanically change between gears by activating the clutch, and the majority of the given structure is similar to a manual gear case; they don't cost a lot of money and are incredibly fuel-efficient.

2. Automatic torque converters
This is the most common automatic gearbox found in automobiles. To enables the gearing to take over car control, the gear converter engine and transmission system employs a hydraulic power connector or a gear box coupled to the plane's electronic manager.

3. Transmission that is constantly variable (TCV)
A Crankshaft can have a "infinite" number of target ratios, allowing the vehicle to accelerate without having to change gears, TCVs use Instead of fixed gears, as well as variable width pulleys and a belt.

4. Semi-automatic transmission (SAT)
A semi-automatic contains a clutch and a gearbox which are managed by sensors, pneumatic valves, computers, and actuators, identical to a manual transmission.

5. Transmission with two clutches (DCT)
A dual-clutch transmission unit, which uses a twin-clutch configuration for alternate speeds, is the most advanced automatic gear case in recent years. When the first clutch is engaged, the second clutch prepares itself ahead of time. It produces smooth and quick changes, resulting in increased acceleration and smoother driving. The disadvantage of this transmission is that it is costly, with frequent repairs being necessary. Several mass-market vehicles, including the Hyundai Venue, Verna, Kia Sonet, and Seltos, will soon be equipped with this transmission.

3.3 AUTOMATIC CARS vs. MANUAL CARS

The fundamental difference between an automatic and a manual vehicle is that a manual vehicle has three pedals: the brake, the accelerator, and the clutch. The motive power engages the clutch and changes the gears manually in the

gearbox. Automatic vehicles can change gears as well, but they do so automatically using sensors.

Automatic Transmissions

Pros:-
1 .Easier to use
2. Less manually restrictive
3. Better for hilly areas
4. Easier to use in heavy traffic

Cons:-
1. Pricy to maintain
2. Not qualified to learn manual

Manual Transmissions

Pros:-
1. Cheaper to maintain
2. Better fuel efficiency
3. Higher management
4. Less likely to be stolen

Cons:-
1. More difficult to learn
2. Heavy traffic driving

IV. ARTIFICIAL INTELLIGENCE IN AUTOMATIC CARS

Artificial Intelligence works by itself without any manual help. It consists of sensors that connect through transmission to Artificial intelligence. The software that is in the car, through which sensors, actuators and software processors are linked to Artificial Intelligence, which takes a view of road and with the help of sensory camera, the vehicle is driven without the help of man. Artificial Intelligence is stimulated by human gestures and works based on the process of decision making. For this, there are deep learning algorithms, machine learning and action control which controls the pedal system like brake, accelerator and clutch as well as steering.

Artificial Intelligence controls the framework of driver controlling system. It can accelerate the speed according to the road whether it is suitable to go on speed or not. Artificial Intelligence can control the brake according to traffic lights or getting obstacles. One of the good things in Artificial Intelligence controlled brake is, it can stop if any obstacles come suddenly in its way. The vehicle connected with Google Street View or Google Maps, so that it can be notified of things like heavy traffic, signals and obstacles earlier.

4.1 ELEMENTS OF ARTIFICIAL INTELLIGENCE IN AUTOMATIC CARS

There are elements of Artificial Intelligence in Automatic Cars which make it possible to work efficiently and the elements are:

I) SENSORS

Sensors sense the respective analog signal and respond accordingly. There are many types of sensors in automobiles like engine sensors, air flow sensors, pressure sensors, fuel temperature sensors, wheel speed sensors and so on. There are countless sensors in automobiles which make it easier to stand on the needs of human. For example, if it is the temperature sensor it will sense the heat that is an analog signal. The particular sensor senses only their respective analog signal. Every millisecond the sensors keep exchanging the information to ECU (Electronic Control Unit) and then it evaluates the range of sensor.

II) ACTUATORS

When the sensor senses something odd then the actuators activates the hydraulic components which are the application orient to the particular operation so the respective actuators actuate the sensor in accordance to the output. When Sensor sends the information to ECU and if the sensor is in the range then it will send it to the actuators to respond back. Basically, sensors provides the input, ECU checks whether it is in range or not and actuators responds in accordance to the sensor.

IV. SENSORS ⟶ ECU ⟶ ACTUATORS

III) COMPLEX ALGORITHMS

The complex algorithm used in AI self driven cars is machine learning algorithms. It helps in integration of sensor data into ECU (Electronic Control Unit) in an automotive. The machine learning algorithms make it perform the task like decision making. The applications includes driving scenario and condition with data fusion of both internal and external sensors like camera, radars, engine speed sensors, temperature sensors and many more.

The application for running a car can receive information from sensors. The machine learning based application can reacts with the driver's gesture, voice guidance or sound recognition. The algorithm can be both supervised learning and unsupervised learning.When the AI automated automobile learns the things again and again until it become confident to work on its own. The supervised machine learning algorithms make sure about it.

When the AI automated automobile works on the accordance of its sensors. The unsupervised learning algorithms have written in a way that the application is divided in a group of similar functions so that it can work efficiently. As the generation is moving forward the new algorithm introduced to make the generation at it ease. The new learning algorithm is named as “Reinforcement Learning”. As the supervised learning has labels means it knows how to tackle with the problem and the unsupervised learning has no labels means it depends on the sensors. The reinforcement learning has sparse and time means it can understand the algorithms merits and demerits so that the application can perform efficiently.

IV) MACHINE LEARNING

The Machine Learning has four categories on which the Artificial Intelligence in Automated Automobile works. The four categories are:

a) Regression Algorithm

The regression algorithm helps in prediction. It can predict the event. In regression algorithm, the camera plays a very important role. With the help of image sampling the statistical model of object can be create where the relation between two objects can be shown. The algorithm returns the position of an object or it can show the presence of any object.

b) Pattern Recognition

The object detected through the sensors needs to recognize the instance of an object. Pattern Recognition algorithm rules out the unusual data points.

Pattern Recognition has an algorithm that helps to reduce the data set by recognising object edges. Pattern recognition algorithms may be used to distinguish line segments and circular arcs.

c) Cluster Algorithm

Sometimes the images obtained by the sensors are not clear which makes it difficult to locate. Like regression, this method identifies the structure from data points. It defines the issue and method classes, and the data may be arranged into groups using the inherent structure.

d) Decision Matrix Algorithm

The Decision Making Algorithm works systematically like identification of an object, analyzing it and rating the relation between the object and obstacles. It mainly used for decision making like whether the car needs to stop or take turns. The decision making includes the classification, recognition and prediction of an event.

V) DEEP LEARNING

Deep Learning is a part of Artificial Intelligence activity that works exactly like the functioning of human brain (how human thinks and do functions while driving). Deep Learning in AI makes sure about the same. The Decision Making and Data Processing are the main functions.

Deep Learning is a part of machine learning which connects itself with the readable networks that can be directed to the random data.

There are four main pillars of Deep Learning which are:

PERCEPTION

It finds the obstacles coming in a way. The camera and radar are the major components of Perception.

LOCALIZATION

It defines the vehicle's position accurately in real time world.

PLANNING

It can define the path or trajectory easily with the help of perception and localization.

CONTROL

It helps to cover the trajectory path with the right angle of steering and wheels.

V. AUTOMATIC CAR ARCHITECTURE

The automobile's importance is undeniable, but we frequently overlook the technology that allows us to travel from one location to another. The automobile has been a component of American society and culture since Henry Ford launched his assembly-line built Model T car in 1908. (McAleen, 2015). Every advancement in the vehicle began with a solution to a problem, resulting in a driving experience that is much different now than it was in 1908. The automated transmission was the most paradigm-shifting, transformative invention in the vehicle.

Early cars had manual transmissions, which required the driver to shift gears with a clutch lever and a third pedal. A transmission is a "system of interlocking gear wheels and a lever that enables the motive force to manually shift ratios." The transmission is nothing more than a gearbox.

Power Equals Torque x Speed

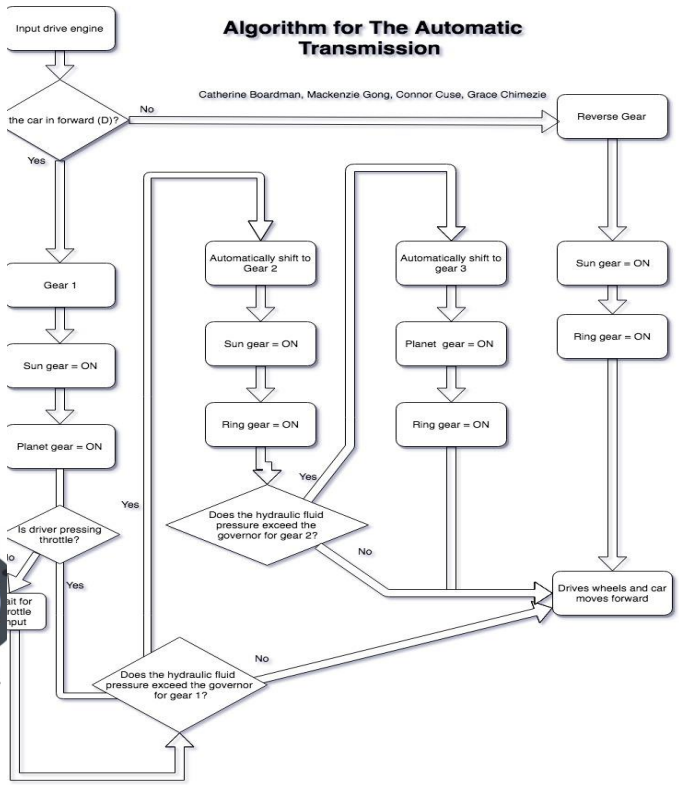

Figure 5.1(Algorithm for Automatic Transmission)

VI. INTELLIGENT TRANSPORTATION SYSTEM

Intelligent Transportation System (ITS) Overview Definition Tc increase security, efficiency, and service, and traffic through transfer the Intelligent Transportation System (ITS) employs advance electronic, communications, computer technology, control, anc hearing and vision across all modes of transportation. curren information

Improvements in road safety, traffic congestion relief, transportatior efficiency, air pollution reduction, and energy efficiency are all goals.

To encourage the growth of relevant Content Content Ir general,Based on their functions, ITS is divided into five systems The ATM monitors traffic conditions, sends them via the networl to the control centre, and creates traffic control strategies by combining various forms of traffic data. ATMS also employs traffic control methodsRamp metering, signal monitoring, speed problem management, automated toll collect, and more continuous vehicle control are some of the features available, as well as capabilities to execute traffic controls and convey information to drivers and relevant agencies. and so forth. 2.With improved communication technology, theThe Advanced Traffic Management Technology, or ATIS, allows drivers to get actual facts in the car, at school, at work, or even outside as a basis for planning journeys and itineraries. The system includes flexible message signals, HAR (Highway Advisory Radio), GPS, internet connection, phone, fax, cable tv, Info key, and mobile phone. Advanced Vehicles Additional safety System is the acronym for Improved Movement Control and Warnin

g Lights. AVCSS employs cutting-edge technology in cars and streets to assist drivers in maintaining vehicle control, preventing accidents, and improving road safety. Driving assistance, rear cross traffic alert and control, automatic lateral and longitudinal control, long-term automated driving systems, and automatic highway systems are all part of the AVCSS.

The Advanced Public Transportation System, or APTS, is a public transportation system that employs ATMS, ATIS, and AVCSS technology to improve service quality, efficiency, and the number of people that use it. Automatic automobile tracking, VPS, computer programming, and E tickets are all part of the system. CVO stands for Commercial Vehicle Operation. To increase efficiency and safety, CVO employsCommercial vehicles like as trucks, coaches, taxes, and ambulances employ Atm services, ATIS, and AVCSS technologies. Automotive monitoring, The method includes ship administration, computer engineering, and electronic payment. Framework Agreements between ITS operations are established in the US DOT and ITS-America model for future ITS development.to maintain uniformity and flexibility. The following are the 7 functions and 30 user services given to drivers:

1. Travel and transportation management • Information on travel services • Speed enforcement • Disaster response • Environmental monitoring and improvement• Crossing the railway line

2. Pre-travel information • Requirement control and business • Travel demand management Carpooling and reservations in advance

3.Mass transit management • Information on public transit while travelling • Personal transport services • Mass transit security

4. Electronic payment • Service for electronic payments

5. Commercial vehicle operation • Public electronic transport permit • Automatic road safety inspection • Car safety monitoring • Commercial vehicle management system • Dangerous goods incident

6. Emergency management • Personal safety and emergency notification • Emergency vehicle management

THE ROLE OF THE TECHNICAL TRANSPORT SYSTEM IN AI:

One of the sectors where AI has been successfully applied is in road transportation, allowing for completely new levels of alliance among drivers. Automobile producers, technology businesses, andorganisationsof researches worldwideare exploring with AI to create commercial and personal mobility vehicles. In combination with actuation, cameras are employedIn such vehicles, there are sensors, control units, and software. A handful of these technologies were developed to take the role of traditional page layout approaches | European Senate Research Institute 4 human pilot in some driving duties (such as parking).Fully autonomous cars (including parcel delivery) are still being tested with a restricted number of driving situations and places, despite Artificial intelligence that capture certain driving functions being widely accessible in the EU market. In general, testing autonomous cars in metropolitan areas is challenging due to the variety of personalities, complicated road systems and processes (intersections, road signs, and so on), and the vehicle's requirement to foresee multiple (sometimes unidentified) indicators of movement.AI may also form a truck combination, which is a grouping of a few heavy-duty vehicle (HGV) vehicles that are close together and can accelerate or brake automatically or concurrently. Although the lead HGV is driven by a person, the operators in the following vehicles may only be engaged when difficult traffic circumstances (such as roundabouts) or unanticipated problems happen. HGV pilot drivers' duties are likely to steadily shrink in the future, until they can be no longer required. Although HGV industries are continuously evaluating truck designs in numerous EU nations,

more testing is required in order to ensure ensure safety criteria are met when assembling vehicles of various sorts in the most difficult road conditions. AI algorithms are also commonly utilised inside this sharing of socioeconomic companies that provide road transportation services. For example, the Uber short-distance sharing platform employs AI algorithms across the board, from passenger riders and drivers to route enhancements. AI is employed in traffic management too, servicing in examination of road patterns, volume, and more characteristics. This might also provide drivers with information on the best path to avoid any traffic jams. In order to satisfy the demands of ground traffic flow, AI technology also assists with traffic lights and spinning robots in real time. Stoplights and street lights that turn in real meeting on-the-ground traffic flow help to keep traffic flowing.

VII. PRIVACY AND SECURITY IN AUTOMATIC CARS

Adoption of A.i. (AI) opens the door to solving a slew of socioeconomic problems; yet, this cannot be done without first securing AI-enabled technology. The objective is to create strong ml algorithms models that can resist a wide range of hostile circumstances. We provide a thorough cyber security evaluation that demonstrates adversarial attacks against AI systems, including elements such as adversary knowledge and abilities, as well as current ways for constructing adversarial scenarios and cyber defence models. We present a systematic framework for discussing AI application attack tactics as well as cyber defences that would defend AI applications from such attacks. Understanding the opposing intentions and capabilities, as well as their history, is criticala few assaults on industry apps in order to develop on AI application defences

During the training and testing phases of machine learning, we gave a thorough review of current security risks and related protective solutions. Because there isn't a thorough literatureit has been reviewed that covering security threats as well as defensive techniques in behalf of the two phases of machine learning.

ATTACKS ON AI SYSTEM

- Attack on surface
- Goal of attacker
- Capabilities & knowledge of attackers
- Strategy

DEFENSES AGAINST AI SYSTEM Assaults

• We classify defences against AI system attacks in this section depending on whether they provide comprehensive defence against adversarial instances or only identify and reject them.

•

Complete defences can be distinguished by whether they apply to assaults initiated during the system's training or testing stages.

CHALLENGES FACED IN THE FUTURE

Adversarial examples might be transferable—adversarial examples designed to deceive one model could simply be used to deceive another.

• The magnitude of adversarial perturbations are difficult to control

• Threats are evolved of unknown unknowns- they are similar to cyber security problems like malware. Machine learning system does have the capability to detect the robust techniques.

Randomization has introduced a strategy for strengthening classifier security against assaults in the randomization classifier.

VIII. CONCLUSION

This study paper has served introduction of several components in Artificial Intelligence and applications of artificial intelligence in Automatic or self-driven car. Artificial intelligence is the major part of transforming the automobile industry. The big companies like Google, Tesla, Mahindra etc. are investing in this region. The AI automated cars will become normal and can be seen here and there. In this study paper, as we learned, if some changes make or modify it can be easily usable in countries where the roads are not in good condition or the ratio of accidents are high. Although the privacy, security and few challenges are here but AI in automatic car is having all the limelight. It will grow in the upcoming years.

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