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Roll no.:-8284  
Sub:-AI  
Domain:-Automobile

# ARTIFICIAL INTELLIGENCE



Name:-Ronak Vijay Patra  
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Sub:-AI  
Domain:-Automobile

# UNIVERSITY OF MUMBAI

PROJECT ENTITLED

**“Advance Driver Automated System (ADAS)”**

SUBMITTED BY

**Mr. RONAK PATRA**

ROLL NO

8284

UNDER GUIDANCE OF

***Prof. Pradnya Kumavat***

SUBMITTED FOR THE FULFILLMENT OF THE CURRICULUM OF DEGREE

OF BACHELOR OF SCIENCE

IN COMPUTER SCIENCE

**PILLAI COLLEGE OF ARTS, COMMERCE &**

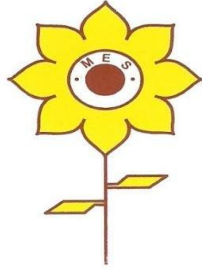
**SCIENCE, NEW PANVEL**

**2021-2022**



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## CERTIFICATE



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MAHATMA EDUCATION SOCIETY'S  
**Pillai's College of Arts, Commerce & Science**  
Dr. K. M. Vasudevan Pillai's Campus, 10, Sector 16, New Panvel 410206.  
(NAAC ACCREDITED 'A' GRADE)

## Certificate

**This is to certify that Mr. Ronak Patra of T.Y B.Sc. C.S. Semester V has completed the project work in the Subject of Artificial Intelligence during the academic year 2022-23 under the guidance of Prof. Pradnya Kumavat being the partial requirement for the fulfillment of the curriculum of Degree of Bachelor of Science in Computer Science, University of Mumbai.**

Signature of faculty

Signature of external



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## **ACKNOWLEDGEMENT**

The Advance Driver Automated System (ADAS) System project is created by Ronak Patra student of Pillai College Of Arts, Commerce & Science would like to express our sincere gratitude towards computer science department.

I would like to thank lecturer Prof. Pradnya Kumavat and for their constant support during the project. Last but not least we thank all my colleagues for being with me throughout the project, which leads to a successful completion of my project. The project would not have been completed without creativity and energy, which our friends provided.

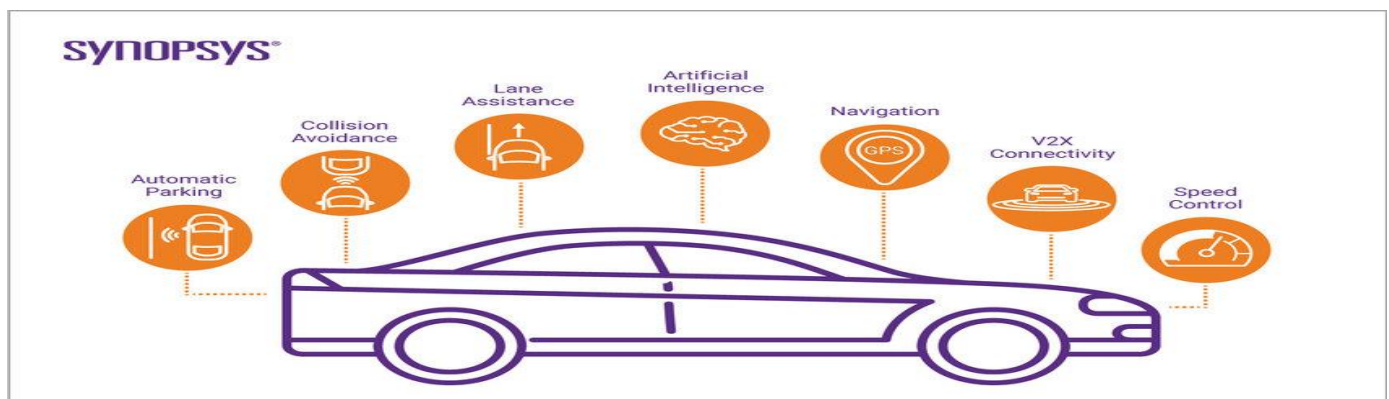
Yours faithfully,

**RONAK PATRA**

## Case Study on ADAS

**1. Abstract:** - Advanced driver-assistance systems (ADAS) are electronic systems in a vehicle that use advanced technologies to assist the driver. They can include many active safety features, and often the terms “ADAS” and “active safety” are used interchangeably.

**2. Executive Summary:** - Almost all vehicle accidents are caused by human error, which can be avoided with Advanced Driver Assistance Systems (ADAS). The role of ADAS is to prevent deaths and injuries by reducing the number of car accidents and the serious impact of those that cannot be avoided.



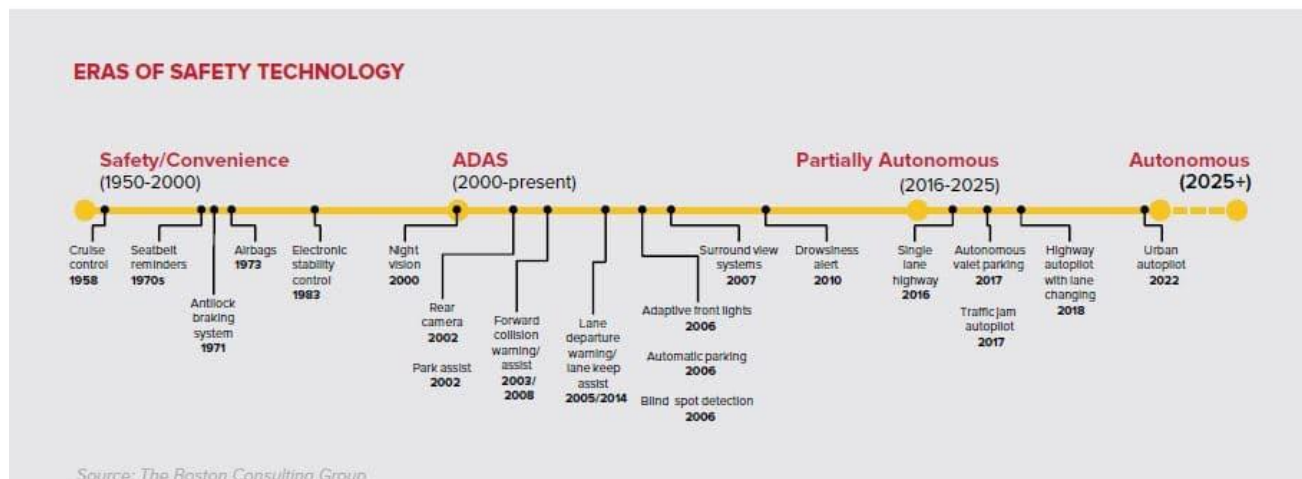
**3. Background:** - Vehicle safety is one of the various areas during which automotive companies are investing heavily. Over the years, automotive companies have developed many technologies, which may be helpful in preventing road accidents. These technologies, which automate, facilitate, and improve vehicular systems to assist drivers for a secure and better driving are referred as Advanced Driver Assistance Systems (ADAS).

According to a recent study by Triton marketing research, the worldwide advanced driver assistance systems (ADAS) market is about to grow to \$80.97 billion by 2027 at a CAGR of 19.46%. At present in India, premium car manufacturers like MG Motor, Volvo, BMW and Mercedes are the ones offering real advanced assistance systems like adaptive control, lane keeping assistance and automatic braking.

Currently, the Indian ADAS market is in its infancy stage and just a little

percentage of vehicles is fitted with these solutions, which fall within the lower levels (1-2) of driving autonomy classification. The Automakers find that the ADAS market in India is rising in response to the escalating need for safer driving conditions.

**4. History:** - ADAS were first being used in the 1950s with the adoption of the anti-lock braking system. Early ADAS include electronic stability control, anti-lock brakes, blind spot information systems, lane departure warning, adaptive cruise control, and traction control. These systems can be affected by mechanical alignment adjustments or damage from a collision. This has led many manufacturers to require automatic resets for these systems after a mechanical alignment is performed.



**5. Dataset:** - Significant automotive safety improvements in the past (e.g., shatter-resistant glass, three-point seatbelts, airbags) were passive safety measures designed to minimize injury during an accident. Today, ADAS systems actively improve safety with the help of embedded vision by reducing the occurrence of accidents and injury to occupants.

The implementation of cameras in the vehicle involves a new AI function that uses sensor fusion to identify and process objects. Sensor fusion, similar to the human brain process information, combines large amounts of data with the help of image recognition software, ultrasound sensors, lidar, and radar. This technology can physically respond faster than a human driver ever could. It can analyze streaming video in real time, recognize what the video shows, and determine how to react to it.



## Features at L2 and lower have existing penetration that will grow rapidly through 2025 – Europe is expected to lead due to regulations

RB Forecast – Take rates by region [% installed on new vehicle sales]



Some of the most common ADAS applications are:-

- i) Adaptive Light Control:-**Adaptive light control adapts the vehicle's headlights to external lighting conditions. It changes the strength, direction, and rotation of the headlights depending on the vehicle's environment and darkness.
- ii) Night Vision:-**Night vision systems enable drivers to see things that would otherwise be difficult or impossible to see at night. There are two categories of night vision implementations: Active night vision systems project infrared light, and passive systems rely on the thermal energy that comes from cars, animals, and other objects.
- iii) Blind Spot Monitoring:-**Blind spot detection systems use sensors to provide drivers with important information that is otherwise difficult or impossible to obtain. Some systems sound an alarm when they detect an object in the driver's blind spot, such as when the driver tries to move into an occupied lane.
- iv) Automatic Emergency Braking:-**Automatic emergency braking uses sensors to detect whether the driver is in the process of hitting another vehicle or other objects on the road. This application can measure the distance of nearby traffic and alert the driver to any danger. Some emergency

braking systems can take preventive safety measures, such as tightening seat belts, reducing speed, and adaptive steering to avoid a collision.

**v) Driver Drowsiness Detection:-**Driver drowsiness detection warns drivers of sleepiness or other road distractions. There are several ways to determine whether a driver's attention is decreasing. In one case, sensors can analyze the movement of the driver's head, and heart rate to determine whether they indicate drowsiness. Other systems issue driver alerts similar to the warning signals for lane detection.

**vi) 5G and V2X:-**This hot new 5G ADAS feature, with increased reliability and lower latency, provides communication between the vehicle and other vehicles or pedestrians, generally referred to as V2X. Today, millions of vehicles connect to cellular networks for real-time navigation. This application will enhance existing methods and the cellular network to improve situational awareness, control or suggest speed adjustments to account for traffic congestion, and update GPS maps with real-time updates. V2X is essential to support over-the-air (OTA) software updates for the now-extensive range of software-driven systems in cars, from map updates to bug fixes to security updates and more.

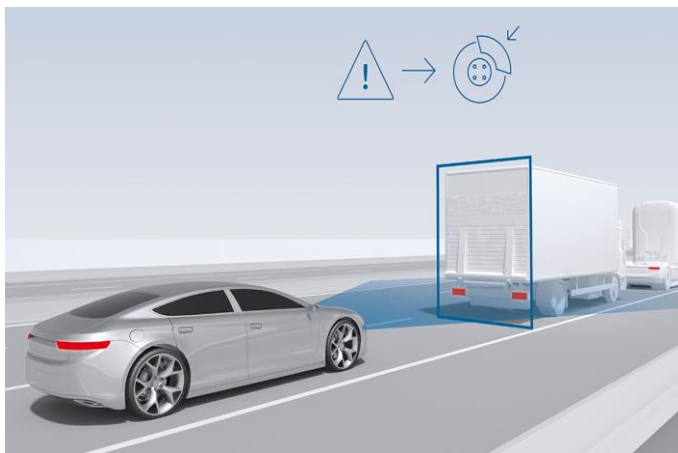
## **6. Case Evaluation:-**

**AUTOMATIC EMERGENCY BRAKING:-**Assists in avoiding rear-end collisions and those with crossing vehicles and mitigate the consequences. Inattentiveness when driving can have serious consequences. To reduce the risk of a rear-end or turn collision or to mitigate their consequences, Bosch has developed automatic emergency braking. Being active when the vehicle is started, it supports the driver at all speeds - by day and by night. However, the driver still has to be attentive and drive carefully at all times.



## The automatic emergency braking protects against rear-end collisions

If the automatic emergency braking detects that the distance to the preceding or stationary vehicle is becoming critically short at a vehicle speed above 30 km/h (18 mph), it prepares the braking system for potential emergency braking. If the driver does not react to the hazardous situation, the system warns the driver via an audible and/or visual signal, followed by a short but noticeable brake jerk.

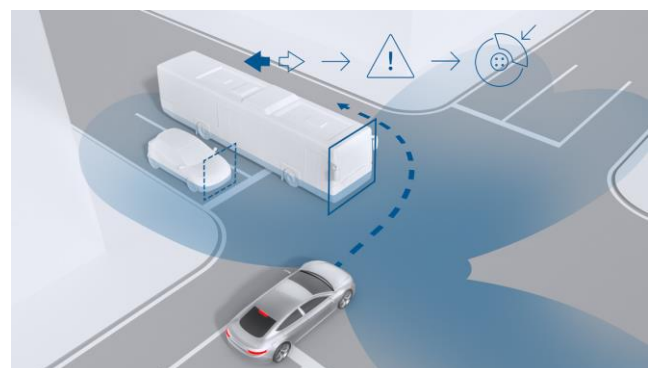


The system then initiates partial braking to reduce the speed and give the driver valuable time to react. As soon as the driver presses the brake pedal, the system provides braking support. To do this, the system continuously calculates the degree of vehicle deceleration required to avoid the collision. If the system detects that the driver has failed to apply sufficient brake force, it increases the braking pressure to the required level so that the driver

can attempt to bring the vehicle to a standstill before a collision occurs. If the driver fails to react to the immediate risk of collision, and the automatic emergency braking determines that a rear-end collision is unavoidable, it can automatically initiate full braking. As a result, the vehicle is traveling at a significantly reduced speed when the collision occurs, reducing the severity of the crash for the passengers of both vehicles.

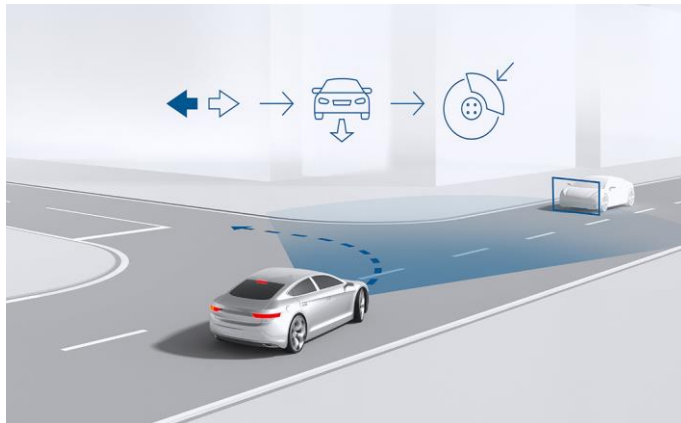
## Automatic emergency braking crossing

Radar sensors installed in the front corners of the vehicle enhance its horizontal field of view and enable it to detect crossing vehicles traveling at higher speeds faster and earlier. The radar sensors are ideally designed for detecting relevant objects in complex urban traffic and differentiating between these. If a crossing vehicle is detected as



a collision opponent, the system warns the driver and triggers automatic emergency braking as late as possible. This gives the driver the opportunity to react before the system intervenes. By this, it helps to avoid or mitigate unavoidable collisions with crossing vehicles.

## Automatic emergency braking turn across path

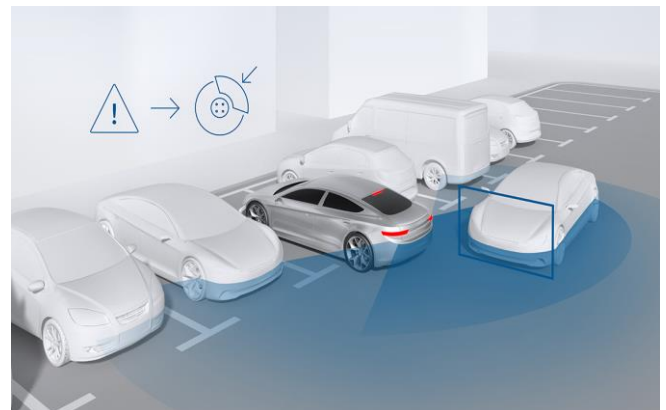


When turning, the driver must not only keep an eye on crossing traffic, but also on oncoming vehicles. Disregarding or misjudging the speed of an oncoming vehicle when turning can quickly become hazardous. That is why Bosch developed the automatic emergency braking additionally for turning scenarios. When the driver's vehicle is stationary in preparation for making a turn and tries to

make the turn even though there is a real danger of colliding with oncoming traffic, the system automatically prevents him from doing so until the danger has passed. When the vehicle is moving at a significant speed despite the risk of a collision, the system issues a warning to the driver as soon as it identifies a dangerous turning situation. The driver remains responsible for taking an appropriate action.

## Automatic emergency braking

**reverse** When backing up, all it takes is a brief moment of inattention to miss a vehicle driving past. Accidents and collisions during parking occur mainly when reversing. The automatic emergency braking reverse alerts the driver of a rear obstacle when reversing and automatically actuates the brakes to avoid a collision based on radar data.



## The drawbacks of automatic emergency braking include:-

- i) Drivers being lulled into a false sense of security if they become over-reliant on such systems.
- ii) False alarms leading to the system suddenly jamming on the brakes and shocking the driver

## 7.Proposed Solutions:-

### Larger CNNs for Whole Frame Object Detection

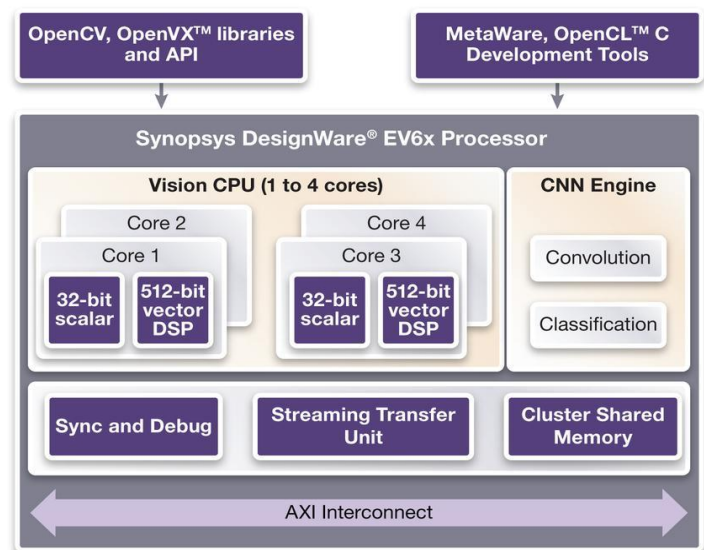
As embedded CNNs(convolutional neural network) become more powerful, they no longer are restricted to processing patches of the incoming image.

*Figure : DesignWare EV6x Embedded Vision Processors include scalar, vector and CNN processing units for both pre- and post-processing*

The benefit of processing the entire image frame is that CNN can be trained to detect multiple objects. Now, instead of just finding a pedestrian, the CNN graph can be trained to find a bicycle, other automobiles, trucks, etc. To do that with an algorithm like HoG would require hand-crafting the algorithm for each new object type.

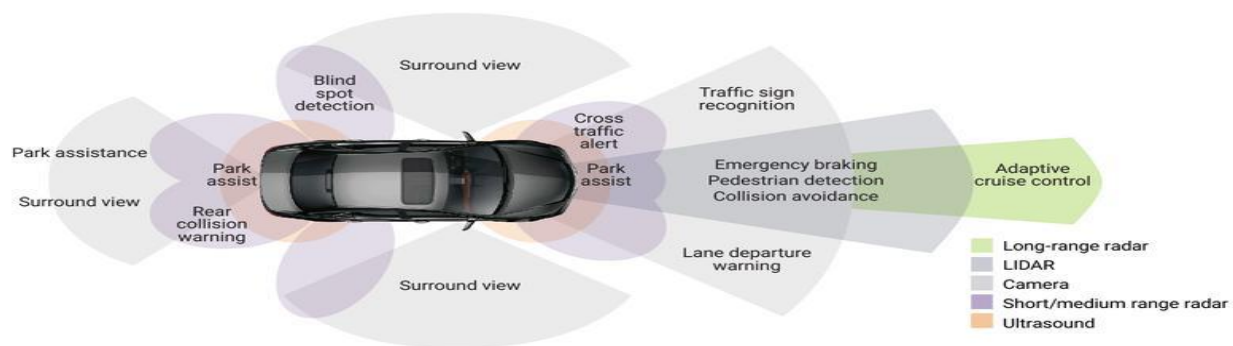
### Future Requirements for Vision Processors in Automotive Vision

Vision processing solutions will need to scale as future demands call for more processing performance. A 1MP image is a reasonable resolution for existing cameras in automobiles. However, more cameras are being added to the car and the demand is growing from 1MP to 3MP or even 8MP cameras. The greater a camera's resolution, the farther away an object can be detected. There are simply more bits to analyze to determine if an object, such as a pedestrian, is ahead. The camera frame-rate (FPS) is also important. The higher the frame rate, the lower the latency and the greater the stopping distance. For a 1MP RGB camera running at 15 FPS, that would be 1280x1024 pixels/frame times 15 frames/second times three colors or about 59M bytes/second to process. An 8MP image at 30fps will require 3264x2448 pixels/frame times 30 frames/second times three colors or about 720M bytes/second.



## 8. Current work of AI in that domain:-

### The Evolution of Deep Learning for ADAS Applications

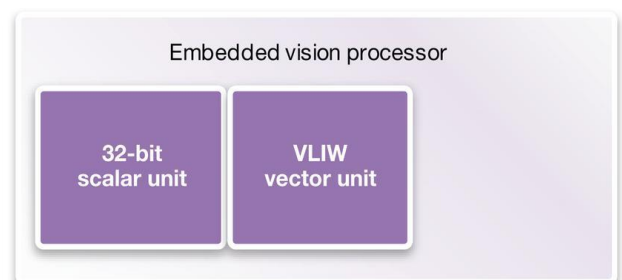


**Vision Processors for Object Detection:-**Since the driver is already facing forward, a front facing camera may seem unnecessary. So, to be of value, the front facing camera has to be consistently faster than the driver in detecting and alerting for obstacles. While an ADAS system can physically react faster than a human driver, it needs embedded vision to provide real-time analysis of the streaming video and know what to react to.

Vision processors are based on heterogeneous processing units. That means the programming tasks are divided into processing units with different strengths (Figure 2). Most of the code will be written using C or C++ for a traditional 32-bit scalar processor, which provides an easy-to-program processor. The vector DSP unit will perform most of the computations, because its very large instruction word can handle a lot of parallel computations for pixel processing of each incoming image.

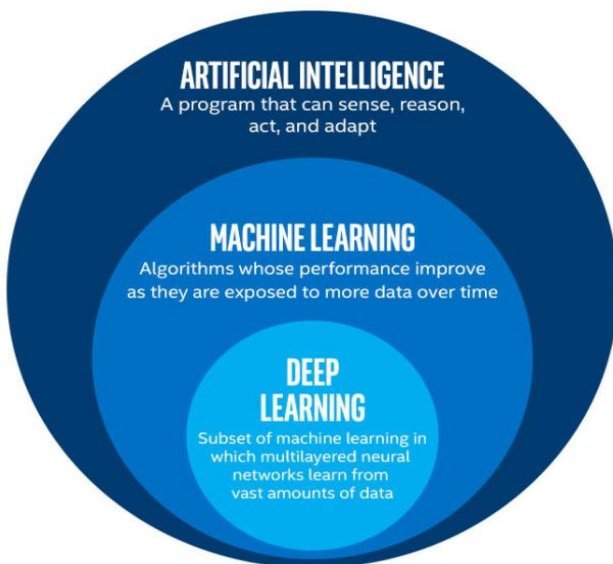
*Figure 2: Vision processors are based on heterogeneous processing units, including scalar and Very Long Instruction Word (VLIW) vector DSP units*

Detecting a pedestrian in front of a car is part of a broad class of “object detection.” For each object to be detected, traditional computer vision algorithms were hand-crafted. Examples of algorithms used for detection include Viola-Jones and more recently Histogram of Oriented Gradients (HoG). The HOG algorithm looks at the edge directions within an image to try to describe objects. HOG was considered a state-of-the art for pedestrian detection as late as 2014.



## Emergence of Deep Learning for Object Detection

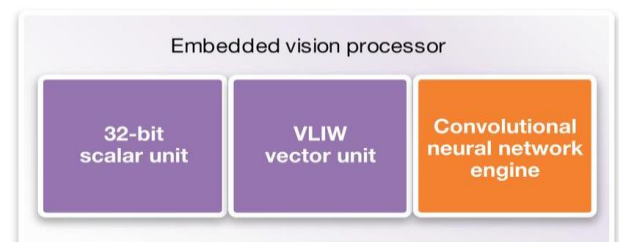
Although the concept of neural networks, which are computer systems modeled after the brain, have been around for a long time, only recently have semiconductors achieved the processor performance to make them a practical reality. In 2012, a convolutional neural network (CNN)-based entry into the annual ImageNet competition showed a significant improvement in accuracy in the task of image classification over the traditional computer vision algorithms. Because of the improved accuracy, the use of neural network-based techniques for image classification, detection and recognition have been gaining momentum ever since.



The important breakthrough of deep neural networks is that object detection no longer has to be a hand-crafted coding exercise. Deep neural networks allow features to be learned automatically from training examples. A neural

network is considered to be “deep” if it has an input and output layer and at least one hidden middle layer. Each node is calculated from the weighted inputs from multiple nodes in the previous layer. CNNs are the current state-of-the art for efficiently implementing deep neural networks for vision. CNNs are more efficient because they reuse a lot of weights across the image.

Early CNNs in the embedded space were performed using a GPU or using the vector DSP portion of a vision processor. However, it’s helpful to look at the task performed in terms of three different heterogeneous processing units



Early implementations of CNNs in hardware had a limited number of Multiply-Accumulator (MAC) units. For example, Synopsys’s EV5x, the industry’s first programmable and configurable vision processor IP cores implemented a CNN engine with 64 MACs. Running at 500 MHz, the EV5x could produce 32 GMACs/s or 64 GOPs/s of performance (a multiply-accumulator performs two operations in one instruction). That was not enough performance to process an entire 1MP (1280 x 1024) frame or image. However, it was enough processing power to perform a CNN on a portion of the image (say a 64x64 pixel patch). To process the entire image, a two-step process for pedestrian detection was needed.



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The vector DSP would perform a computationally intensive Region of Interest (ROI) algorithm on each incoming image of the video stream. ROI identifies candidates using a sliding window approach that could be a pedestrian (ruling out, for example, portions of the sky). Those “pedestrian” patches were then processed by the CNN to determine if it was in fact a pedestrian. CNN-based pedestrian detection solutions have been shown to have better accuracy than algorithms like HoG and perhaps more importantly, it is easier to retrain a CNN to look for a bicycle than it is to write a new hand-crafted algorithm to detect a bicycle instead of a pedestrian.

## Training and Deploying CNNs

As mentioned earlier, CNN is not programmed. It is trained. A deep learning framework, like Caffe or TensorFlow, will use large data sets of images to train the CNN graph – refining coefficients over multiple iterations – to detect specific features in the image. Figure 5 shows the key components for CNN graph training, where the training phase uses banks of GPUs in the cloud for the significant amount of processing required.

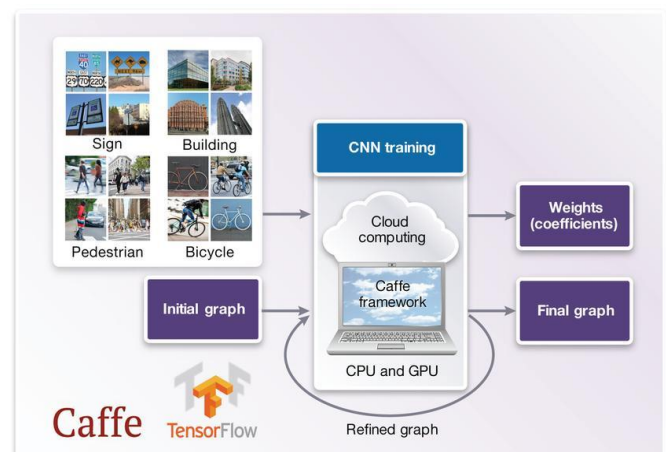
*Figure 5: Components required for graph training*

The deployment – or “inference” – phase is executed on the embedded system. Development tools, such as Synopsys’s MetaWare EV Toolkit, take the 32-bit floating point weights or coefficients output from the training phase and

scale them to a fixed point format. The goal is to use the smallest bit resolution that still produces equivalent accuracy compared to the 32-bit floating point output. Fewer bits in a multiply-accumulator means less power required to calculate the CNN and smaller die area (leading to lower the cost) for the embedded solution. Based on Synopsys calculations, 10-bit or higher resolution is needed to assure the same accuracy of the 32-bit Caffe output without graph retraining.

The MetaWare EV tools take the weights and the graph topology (the structure of the convolutional, non-linearity, pooling, and fully connected layers that exist in a CNN graph) and map them into the hardware for the dedicated CNN engine. Assuming there are no special graph layers, the CNN is now “programmed” to detect the objects that it’s been trained to detect.

To keep the size small, the CNN engine is optimized to execute for key CNN features such as 3x3 and 5x5 matrix multiples, but not so optimized that it becomes a hard wired solution. It’s important to be programmable to maintain flexibility. As CNNs continue to evolve – new layer techniques or pooling



methods for example – the vector DSP can play another important role in the vision processing. Since the vector DSP and CNN engine are closely coupled in the Synopsys EV6x, it is easy to dispatch tasks from the CNN to the vector DSP as needed. OpenVX runtime, incorporated into the MetaWare EV tools, makes sure those tasks are scheduled with other vector DSP processing requirements. The vector DSP future-proofs the CNN engine.

Figure 6 shows the inputs and outputs of an embedded vision processor. The streaming images from the car's camera are fed into the CNN engine that is preconfigured with the graph and weights. The output of the CNN is a classification of the contents of the image.

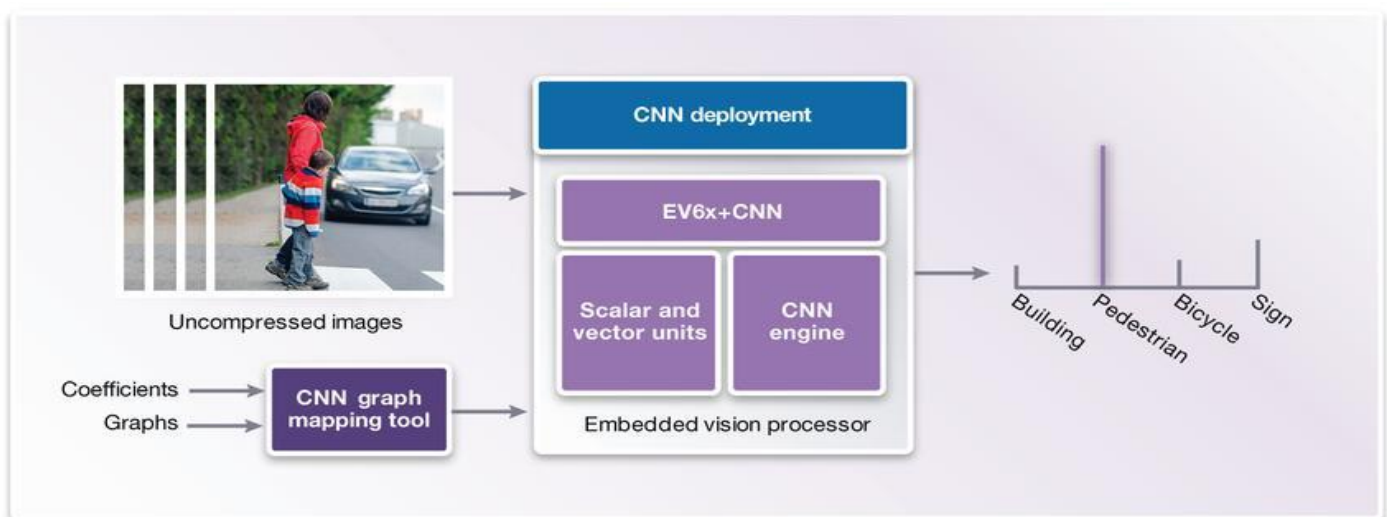


Figure 6: Inputs and outputs of embedded vision processor

## Scene Segmentation and Navigation

Up to now, we've discussed object classification of pedestrians (or bicycles or cars or trucks) that can be used for collision avoidance – an ADAS example. CNNs with high enough performance can also be used for scene segmentation – the identifying of all the pixels in an image. The goal for scene segmentation is less about identifying specific pixels than it is to identify the boundaries between types of objects in the scene. Knowing where the road is compared to other objects in the scene provides a great benefit to a car's navigation and brings us one step closer to autonomous vehicles.

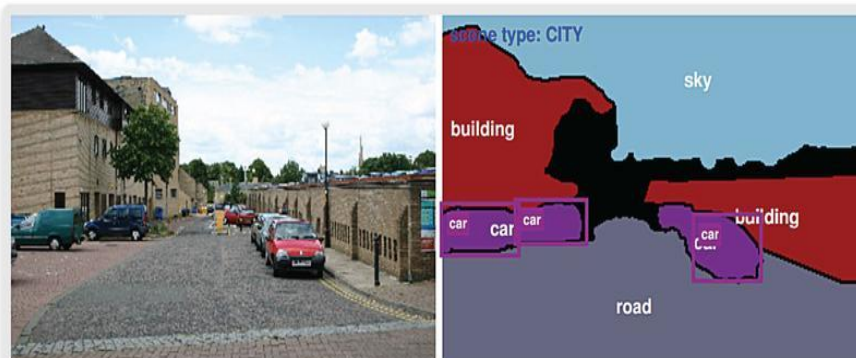


Figure 7: Scene segmentation identifies the boundaries between types of objects

One scene segmentation example, running on a

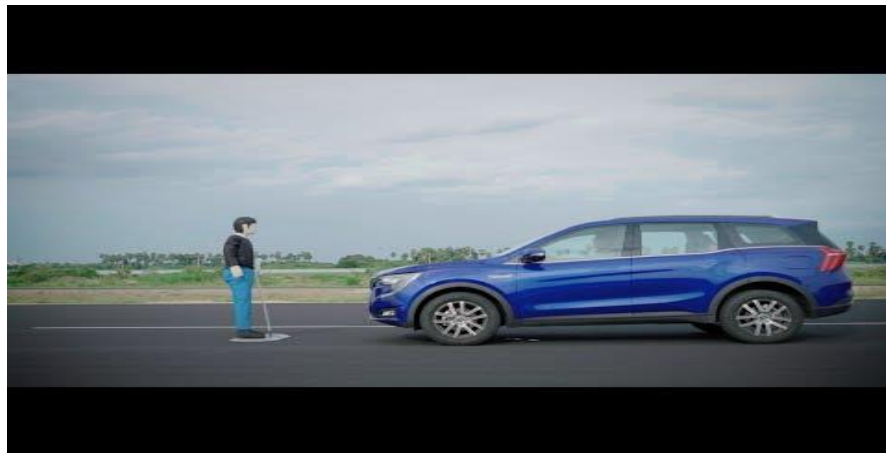


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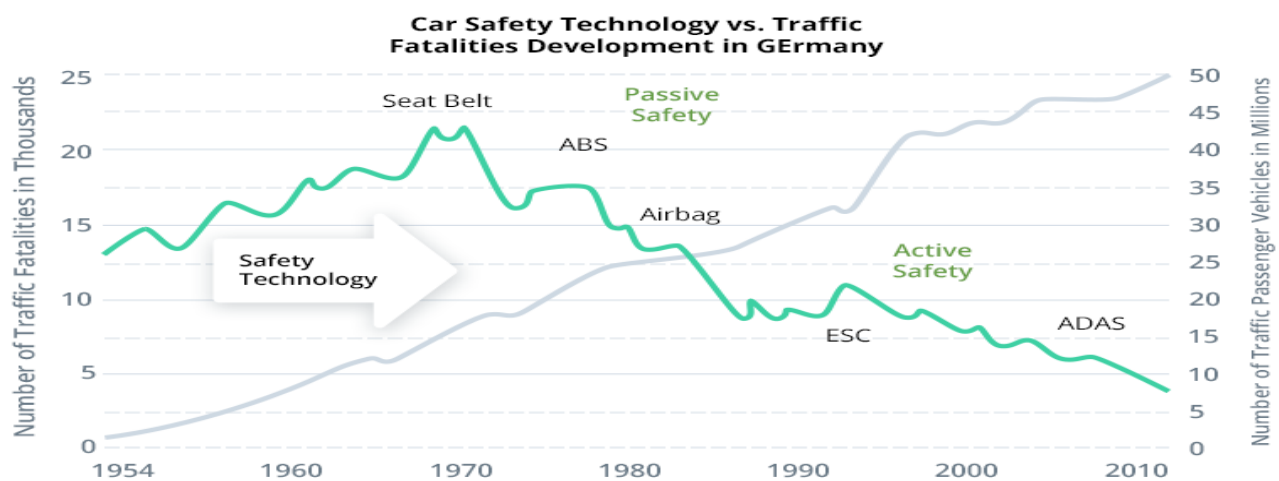
DesignWare EV61's CNN, segmented the streaming images using 11 categories of objects (road, sky, buildings, pedestrians, etc.). With five channels of 1920x1080 images as input, the CNN, running at 800MHz, achieved 18fps. Scene segmentation is difficult for CNNs that don't have the horsepower to process multiple instances of the full images (frames).

## 9. Video clip/ Demo

### Mahindra XUV700 - Advanced Driver Assistance Systems



**10. Conclusion:-** ADAS systems have tremendous potential to increase the safety, comfort, and effectiveness of our vehicles and transportation systems. By many ADAS is seen as a stepping stone to fully autonomous vehicles.



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## 11. References:-

- 1)<https://www.youtube.com/watch?v=oHghwvgSThI>
- 2)[https://www.youtube.com/watch?v=9\\_0zmTmja3o](https://www.youtube.com/watch?v=9_0zmTmja3o)
- 3)<https://www.youtube.com/watch?v=WVJdyuNfqDY>
- 4)<https://www.youtube.com/watch?v=NOqqqigrbsE>
- 5)<https://www.youtube.com/watch?v=2C4rretPrCs>
- 6)<https://aicurious.io/posts/adas-jetson-nano-software/>
- 7)<https://medium.com/@chelsie.may/top-9-adas-software-development-companies-for-automotive-9699bd772303>
- 8)[https://github.com/vamsiramakrishnan/AdvancedLaneLines/blob/master/Advanced\\_Lane\\_lines\\_Final.i  
pynb](https://github.com/vamsiramakrishnan/AdvancedLaneLines/blob/master/Advanced_Lane_lines_Final.ipynb)

# CHATBOT

**What is Chatbot:-**At the most basic level, a chatbot is a computer program that simulates and processes human conversation (either written or spoken), allowing humans to interact with digital devices as if they were communicating with a real person.

**Code:-**

```
from chatterbot import ChatBot
from chatterbot.trainers import ListTrainer
bot=ChatBot('Test')
conv=open('question.txt','r').readlines()
trainer = ListTrainer(bot)
trainer.train(conv)

while True:
    request=input('you: ')
    response=bot.get_response(request)
    print("Bot",response)
```

**Questions:-**

1) What is ADAS safety?

->Through a safe human-machine interface, ADAS increase car and road safety.

2) Who invented ADAS technology?

->Modern cruise control was invented by Ralph Teetor.

3) Why is ADAS important?

->The role of ADAS is to prevent deaths and injuries by reducing the number of car accidents and the serious impact of those that cannot be avoided.

4) What are the disadvantages of ADAS?

->ADAS features may not work correctly all the time.

5) Where are ADAS sensors located?

->These ADAS sensors are positioned inside the front and/or rear bumper covers.

6) How is a camera used in ADAS?

->Advanced Driver Assistance Systems (ADAS) using camera-based sensors help the driver and vehicle have greater awareness of the driving environment.

7) Are parking sensors considered ADAS?

->Parking assistance is an advanced driver assistance system (ADAS) that helps drivers park more safely.

8) What is ADAS and its features?

->Advanced driver-assistance systems (ADAS) are electronic systems in a vehicle that use advanced technologies to assist the driver.

9) What percentage of vehicles have ADAS?

->"At least one ADAS feature is available on 92.7 percent of new vehicles available in the U.S. as of May 2018," AAA reports.

10) What car has the most advanced safety features?

->Here are six of the best-advanced car models available today!

11) When was ADAS invented?

->Its origin dates as far back as 1948, when the first modern cruise control was invented. Between the 1950s and 2000s.

12) What is the future of ADAS?

->A recent McKinsey report says that though current revenues for ADAS vendors are still moderate, most industry experts expect to see an annual increase of more than 10 percent from 2015 to 2020.

13) Is ADAS and autonomous driving is same?

->As you may be aware, there is a difference between ADAS and autonomous driving.

14) Does ADAS work in manual transmission?

->No, ADAS is available for only automatic variants of Sharp Astor.

15) Which software is used for ADAS?

->ADASENS Automotive GmbH:The most highly praised ADAS technology developed by ADASENS is automotive parking camera and traffic sign recognition software.

16) Why is ADAS bad?

->Advanced Driver Assistance Systems (ADAS) might cause more crashes according to new research.

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17) Is ADAS necessary?

->The ADAS equipment in your vehicle has been developed to keep you safe and to make driving easier.

18) How much does an ADAS system cost?

->\$850 to \$1,900: Camera sensors for adaptive cruise control and automatic emergency braking systems.

```
List Trainer: [#####] 100%
YOU :what is adas?
BOT : Advanced driver assistance systems
YOU :What is ADAS safety?
BOT : Through a safe human-machine interface, ADAS increase car and road safety.
YOU :What are the disadvantages of ADAS?
BOT : ADAS features may not work correctly all the time.
YOU :Are parking sensors considered ADAS?
BOT : Parking assistance is an advanced driver assistance system (ADAS) that helps drivers park more safely.
YOU :Is ADAS and autonomous driving is same?
BOT : As you may be aware, there is a difference between ADAS and autonomous driving.
YOU :Why is ADAS bad?
BOT : Advanced Driver Assistance Systems (ADAS) might cause more crashes according to new research.
YOU :How much does an ADAS system cost?
BOT : $850 to $1,900: Camera sensors for adaptive cruise control and automatic emergency braking systems.
YOU :Is ADAS necessary?
BOT : The ADAS equipment in your vehicle has been developed to keep you safe and to make driving easier.
YOU :When was ADAS invented?
BOT : Its origin dates as far back as 1948, when the first modern cruise control was invented. Between the 1950s and 2000s.
YOU :What car has the most advanced safety features?
BOT : Here are six of the best-advanced car models available today!
YOU :
```



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THANK YOU

Pillai