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Autonomous Driving Industry Dynamics Research Report

AI and Big Data Financial Management Fund

*For Synthra Capital investors only

CONTENT

1. Preface

Perception-planning-control, algorithm iteratively drives the implementation of high-end intelligent driving
Smart driving cars are essentially one of the products of embodied intelligence (the ultimate analogy is equivalent to a large wheeled robot). Compared with service robots, smart driving cars replace the driver's labor to a certain extent (home service robots replace nannies), and drivers Driving behavior is a relatively standardized action. If the requirements of safety regulations are not considered, and purely from the perspective of technical implementation difficulty, smart cars are expected to become an early embodied smart product.

Every round of prosperity driven by new technologies is inseparable from the following four factors:
1) A breakthrough in the underlying technology. The underlying technology of electrification is reviewed in three electrical products, especially batteries. When the cruising range and cost reach a stage that is relatively suitable for mass production, and the completeness of the industrial chain improves, it will lay a solid foundation for hot-selling products. The disruptive innovation at the bottom of intelligent technology is improving the level of artificial intelligence in this round. Based on the "Attention Is All You Need" proposed by Google in 2017, the perceptual layer algorithm model BEV+Transformer led by Tesla in 2021 It continues to iterate, and we expect an end-to-end large model to be launched in 2023.

2) Popular products appear. After technological breakthroughs and cost parity, iconic hot-selling products will first appear. The hot-selling electrified products will appear in 2020. Model 3 is the iconic hot-selling product of Tesla and BYD, and the follow-up Tesla FSD will be the same. Entering China, it is expected to become a new hot-selling intelligent model.

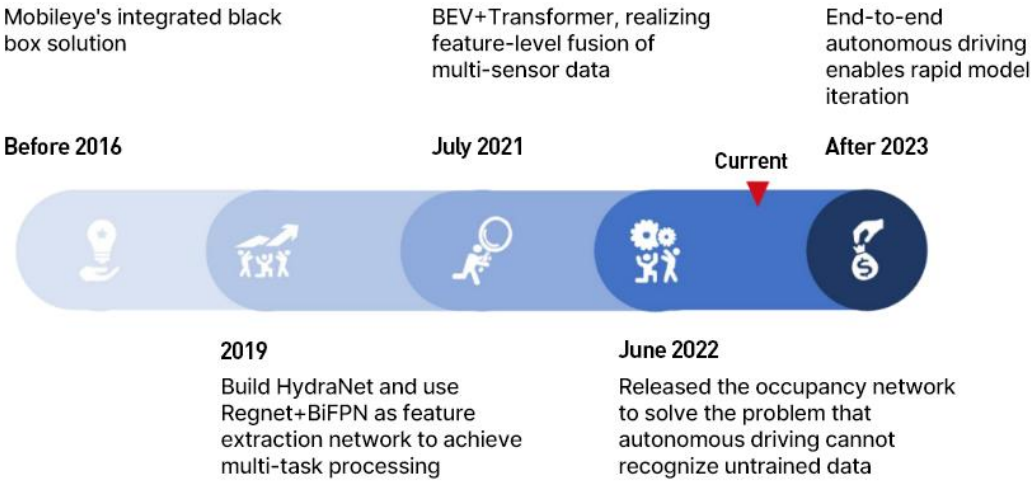
3) Sustainable tracking data. The data on electrification are relatively complete (sales volume and penetration rate). Intelligence currently does not have a recognized standard L3 level penetration data that can track Tesla FSD assembly rate data.

4) Markets at home and abroad resonate. The overseas electrification market started first. Tesla began to surge with the construction of the Shanghai factory at the end of 2019. In the first half of 2020, it was transmitted to the new power car companies in the US stock market. This round of intelligent market is in Tesla.

The current intelligentization of automobiles already has technological breakthroughs (large models on the car), the emergence of popular products, and sustainable tracking data (resonating at home and abroad. The space for intelligent driving is huge, the singularity is approaching, and technology iterations and product penetration are expected accelerate.
There is a huge space for labor substitution: There is a huge space for labor substitution for smart driving cars. Assume that the labor cost of driving is calculated at US$200 per month (conservatively assuming that the monthly salary of an operating vehicle driver is US$700, and the private car driving time is one-quarter of that of an operating vehicle driver). (1 calculation),

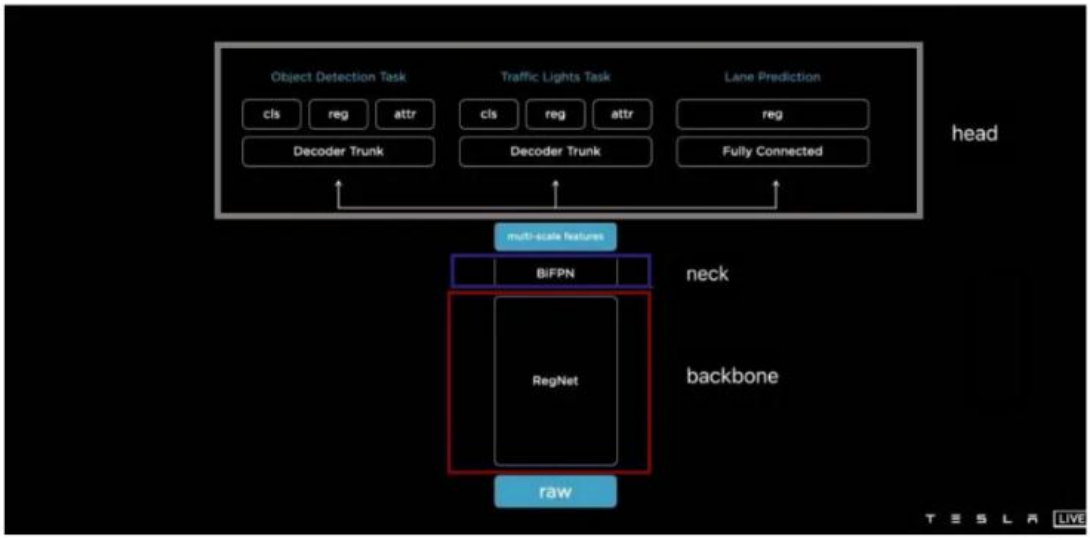
after the realization of autonomous driving, it is estimated that the annual labor cost savings per vehicle is expected to exceed US$2,000. Considering the 6-8 year vehicle life cycle, the labor cost savings during the life cycle of each vehicle is nearly US$1,500. The labor cost saved by autonomous driving It can cover the current charges for high-end autonomous driving at home and abroad, and there is considerable room for improvement in penetration rate. There are 1.4 billion cars in the world. We estimate that the global car driver labor market space saved by 100% penetration of autonomous driving in the future is expected to exceed 100 billion US dollars (annualized).

Tesla's FSD algorithm continues to be upgraded (BEV+Transformer in 2021-0ccupancyNetwork introduced in 2022-end-to-end integrated large model may be introduced in 2023), leading the development of the industry. Tesla began to develop self-driving software algorithms in 2016. In 2019, it launched the self-built HydraNet network, giving the self-driving model the ability to handle multiple tasks at the same time. It then introduced the Transformer network architecture based on Google's "Attentionls All You Need." The BEV+Transformer perception model launched in 2021 unifies multi-angle image data into an overhead view; 0ccupancynetwork is proposed in 2022 to improve the 3D space network occupancy detection capability and solve the problem of unrecognizable data that does not appear in the training set during the autonomous driving process. Condition. During this period, the autonomous driving program transmitted the environment, speed and other data processed by the perception model downwards to the control model. Tesla introduced interactive search and gradually added constraints (game behavior of other participants) to make optimal path planning. After 2023, Tesla will further propose an end-to-end large-scale algorithm, turning the perception and planning model into a large fusion model, achieving breakthroughs in directly inputting sensor data to outputting steering, braking and other driving instructions. On the one hand, it reduces the training process of intermediate modules such as perception and decision-making, effectively centralizing model training resources; avoiding errors caused by multi-level transmission of data; at the same time, there is no deviation between the goals of each sub-module and the overall system goal, ensuring maximum benefits change.



2. Data fusion and neural network build the bottom layer of intelligent driving solutions

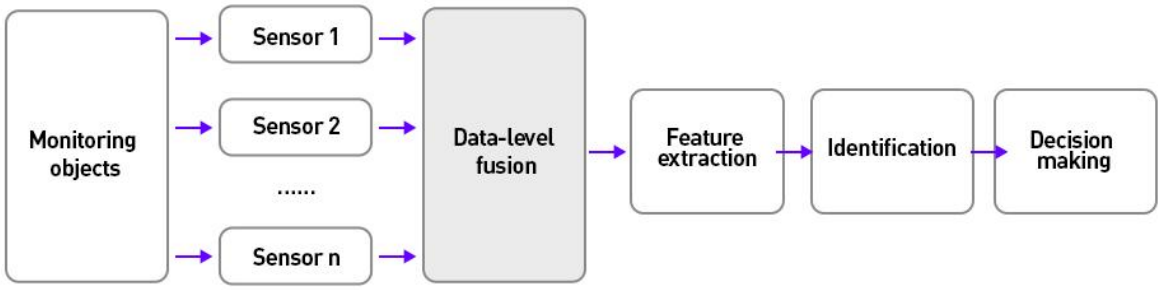
At present, the network infrastructure in the autonomous driving industry is generally Input->backbone->neck->head-output. Taking Tesla as an example, its autonomous driving concept is to build a computer neural network system that imitates the human brain based on vision through a deep learning model, and process the camera image data into a bird's-eye view mode through several steps of fusion, feature extraction, recognition, and decision-making. Or the 3D space occupancy is used for subsequent path planning, and the processing order of each company is different. Specifically, Tesla's self-built HydraNet network inputs the original image data of the camera at the input end, extracts the image feature data through the neural network architecture of the backbone layer, and inputs the features into the neck to make adjustments combined with subsequent path planning and other tasks, and then Assign time information to the feature data to further integrate different time information of the target, and transmit the results to each heads to complete subsequent tasks. The core of the entire algorithm lies in feature extraction and data fusion. Efficient data processing and effective perception layer construction are the basis for the implementation of autonomous driving. Tesla mainly focuses on visual image data. Other car companies will also choose to integrate multi-sensor data such as millimeter wave radar, ultrasonic radar, laser radar, etc., and perform data processing sequences such as feature extraction, recognition, fusion, and decision-making. There are differences, so data fusion can be divided into three modes: pre-fusion, post-fusion, and feature-level fusion.



Tesla autonomous driving network architecture

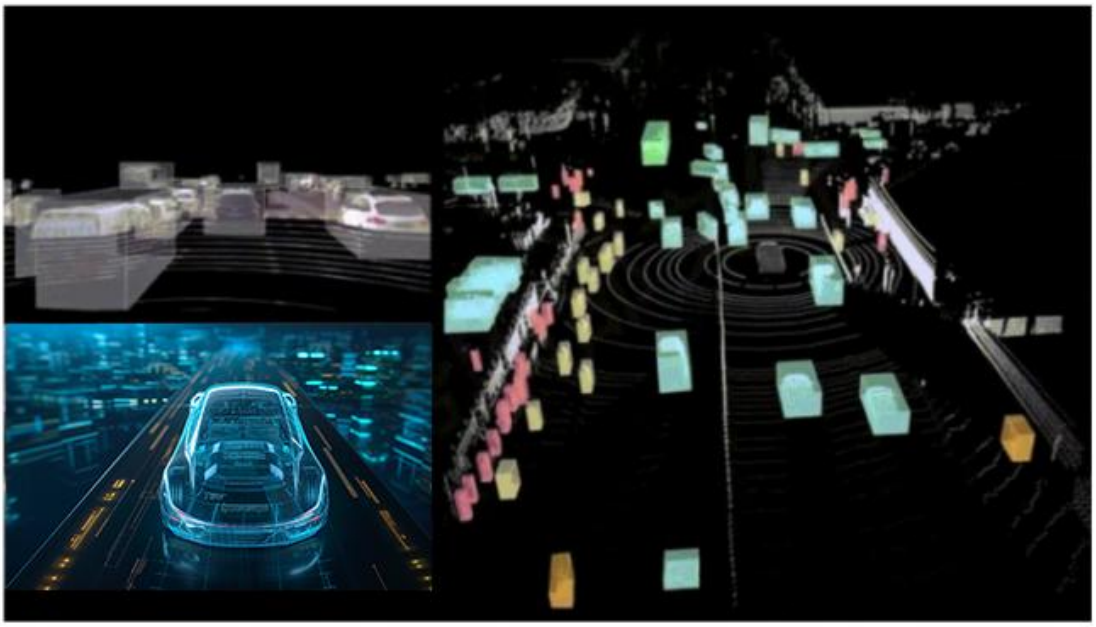
2.1 Feature-level fusion integrates the advantages of low data loss and low computing power consumption

1) Pre-fusion: Sensor data fusion requires a large amount of calculation and is currently not widely used in the industry.
Pre-fusion, also known as data-level fusion, refers to the fusion of sensor observation data, and then extracts feature vectors from the fused data for judgment and recognition. Its characteristic is that it has only one perception algorithm to perceive the fused multi-dimensional comprehensive data.



Schematic diagram of the basic principles of multi-sensor front fusion

The advantage of pre-fusion is that there is no problem of data loss and the results obtained are more accurate. Pre-fusion belongs to the underlying data fusion. Directly fusion of raw observation data from multiple sensors, such as laser radar point cloud data and camera pixel-level data, results in less data loss; the main challenge lies in the large amount of calculation and the The requirements for computing power and fusion strategy are high. Since visual data is a 2D image space and laser radar point cloud is a 3D space, when fusion is performed, either the point cloud is put into the image space to provide depth information for the image, or the point cloud is placed in the image space. In the cloud coordinate system, by coloring the point cloud or doing feature coloring, the point cloud has richer semantic information.



Schematic diagram of the fusion effect in front of camera and laser radar

2) Post-fusion: The output results of each sensor are fused at the decision-making layer, which is the mainstream solution in the early stage of intelligent driving. It is also called target-level fusion and decision-level fusion, which refers to the independent processing and generation of each sensor. For target data, each sensor has its own independent perception algorithm, such as visual perception algorithm, laser radar perception algorithm, millimeter wave radar perception algorithm, etc., thereby each outputting results with the sensor's own attributes. And at the decision-making level, the main processor performs data fusion, which is also the current mainstream solution.
The advantages of post-fusion are 1) different sensors independently perform target recognition, with good decoupling, and each sensor can be a redundant backup for each other; 2) For OEMs, the post-fusion algorithm is relatively simple. The recognition results of each sensor are input to the fusion module. The fusion module sets different confidence levels for the recognition results of each sensor in different scenarios, and finally makes decisions based on the fusion strategy; 3) Lower computing power requirements , referring to the car heart data, the post-fusion strategy requires the computing power of the car to be within 100TOPS, but the front-fusion strategy requires 500-1000TOPS computing power. The disadvantage of post-fusion is that under the post-fusion strategy, low-confidence information will be filtered out and the original data will be lost.

3) Feature-level fusion: less data loss than post-fusion, less computing power consumption than pre-fusion, and greater use in the BEV space
Feature-level fusion, also called intermediate-level fusion, refers to first extracting intermediate-level features (i.e., effective features) from each sensor through a neural network model, and then fusing the effective features of multiple sensors, thereby More likely to get the best possible reasoning. The advantage of feature-level fusion is that compared with post-fusion, it has less data loss and higher accuracy. Compared with pre-fusion, it consumes less computing power. Referring to the data from the heart of the car, feature-level fusion requires approximately Between 300-400TOPS.

The pre-fusion algorithm requires high computing power and is currently more popular in academia. The post-fusion algorithm will cause serious original data loss problems. The feature-level fusion algorithm has the two major advantages of less data loss and less computing power consumption. After being proposed, it has been widely used by car companies and suppliers; Tesla uses a pure visual solution to achieve the best trade-off between computing power and inference results through feature-level fusion.

After inputting original data such as cameras, the perception layer of autonomous driving includes several steps of fusion, feature extraction, recognition, and decision-making. Car companies choose data fusion solutions based on their own sensor configurations and choose different neural networks. Image feature extraction, data fusion and other processing processes, according to different internal structures, neural network models can generally be divided into DNN, CNN, RNN, Transformer, etc. Different neural network structures will provide different features during the processing process. Boosting effect.

2.2 Neural network model from CNN to Transformer, efficiency improved

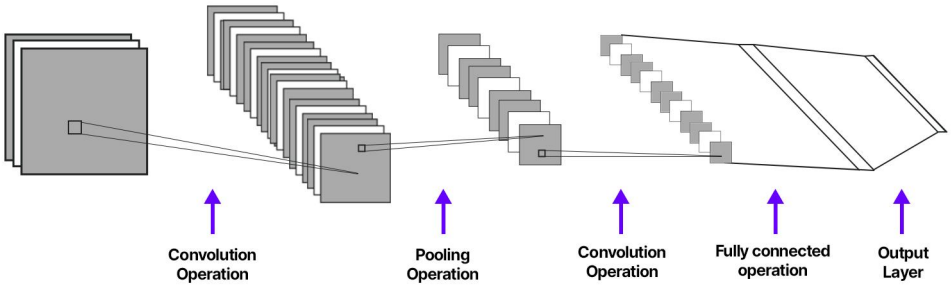
2.2.1 DNN (Deep Neural Network): Fully connected neural network, which has problems such as low efficiency

The basis of DNN is neurons. The neural network is composed of neurons. Its function is to receive n inputs and then give an output. The specific calculation process is designed according to needs. Adding a hidden layer between the input layer and the output layer forms a DNN (deep neural network). The hidden layer is a layer composed of many neurons and links between the input layer and the output layer. If there are multiple hidden layers, it means The number of hidden layers with multiple activation functions should be set according to actual problems. Setting too much will cause a waste of computing resources, and setting too little will reduce the accuracy of the results. The direction of the arrow in the figure below represents the direction of forward propagation. , the result obtained by each neuron will be passed to all the neurons in the next layer. This is why DNN is also called a fully connected neural network. The final result is obtained by passing it layer by layer.

The problem with DNN (Deep Neural Network) is that too many parameters are inefficient and training is difficult; a large number of parameters will quickly lead to network overfitting, and the autonomous driving perception layer inputs more data, and CNN (Convolutional Neural Network) It can effectively solve the above problems.

Convolution NeuralNetwork is a feedforward neural network, which is essentially a multi-layer perceptron. The reason for the successful launch of CNN is to "simplify complex problems", reduce the dimensionality of a large number of parameters into a small number of parameters, and then process it through convolution The local connection and weight sharing methods used

by the layer and the pooling layer are used to reduce the dimension: on the one hand, the number of weights is reduced, making the network easier to optimize; on the other hand, the complexity of the model is reduced and overfitting is reduced. The risk applies to image recognition.

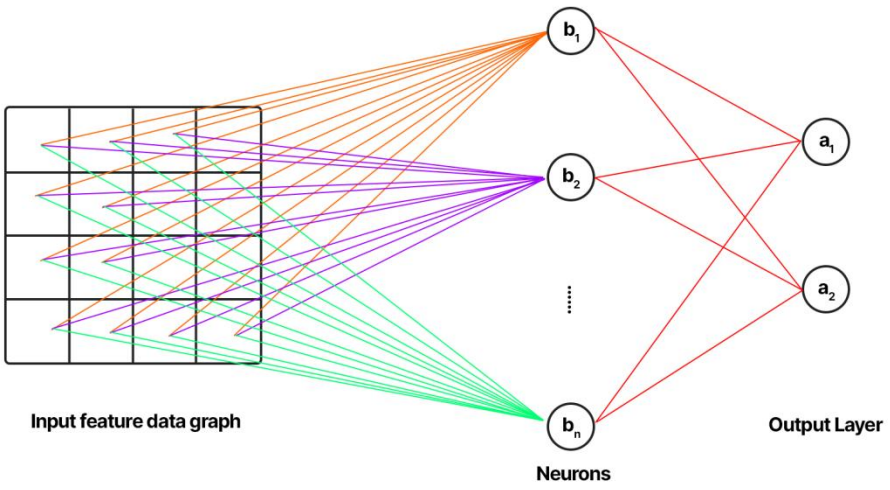


CNN convolutional neural network structure diagram

CNN classification images generally require convolution operations, pooling operations, and fully connected operations for prediction and recognition.
1) Convolutional layer: The main function of the convolutional layer is to extract features from the input image or feature map. The convolution kernel is equivalent to a sliding parameter window, which implements fixed step size and regular sliding on the input image or feature map. Each time it slides, corresponding calculations are performed with the corresponding area of the input image or feature map to obtain values representing local feature information.

2) Pooling layer: The role of the pooling layer is to reduce the data processing dimension while retaining important features. The main operation of the pooling layer is to sample the output feature map of the previous layer. There are three general sampling methods: maximum pooling, average pooling and mixed pooling.

3) Fully connected layer: Usually located at the bottom of the network, it is often used for classification tasks. In a classification network, the fully connected layer can be the probability of the output result. As shown in the figure below, the input data is a matrix of size 4x4, b1, b2,...,bn are hidden layer neurons, and a1 and a2 are output neurons.

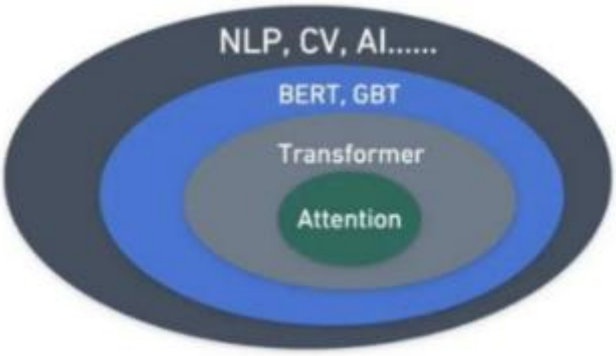


Full connection mode

If only the fully connected layer of DNN is used for feature extraction, the complexity of the network will be increased and the computational complexity will be high. In contrast, the CNN convolutional neural network first perceives the local part, and then synthesizes the local information at a higher level to obtain the global picture. information, with the characteristics of both local connection and weight sharing: 1) Local connection: The convolution operation uses a convolution kernel to connect the input feature map to the neurons through a sliding window. Compared with the full connection, this method effectively reduces the network path complexity, which improves the performance of online learning data features; 2) Weight sharing: For the entire process of processing the input feature map by the posterior connection, the convolution kernel used is the same convolution kernel, so the calculation requires The weight matrices are the same, that is, the weights are shared.
The reason why CNN convolutional neural network is suitable for image recognition is that the CNN model limits the number of parameters and mines the characteristics of local structures. Its shortcoming is that on the one hand, CNN cannot encode relative spatial information and only focuses on detecting certain features without considering the relative positions between them: on the other hand, the pooling layer will compress local features into a single value. These values cannot fully represent the original feature information, resulting in the possible loss of some valuable feature information.

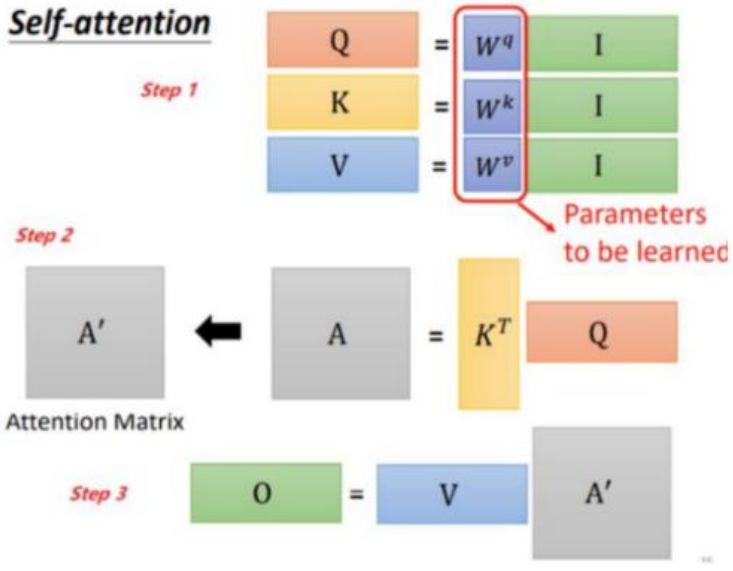
2.2.2 Transformer: Excellent performance in parallel computing, retaining location information, capturing long-distance features, etc.

Transformer is a neural network model based on the attention mechanism (Attention Mechanism) proposed by Google in the 2017 paper "Attention is All You Need". Its advantage over RNN is that it can be calculated in parallel and can handle long sequences of inputs. Compared with The advantage of CNN is that it retains location information and solves the problem of long-distance feature dependence. Therefore, the Transformer model has become one of the most popular models in the field of natural language processing.
The attention mechanism is derived from the human visual attention mechanism: focusing limited attention on key information from focusing on all to focusing on key points, thereby saving resources and quickly obtaining the most effective information. Attention is a weight parameter allocation mechanism. The goal is to help the model capture important information. It is essentially a weighted summation.



The core of the Transformer architecture is the Attention mechanism

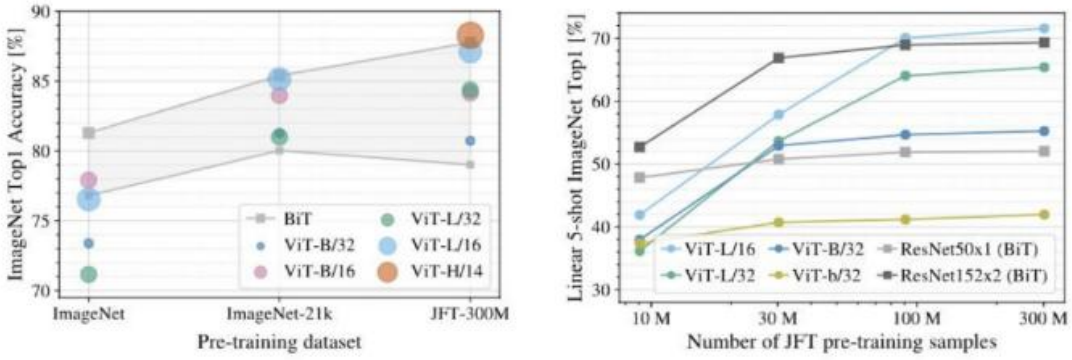
The Encoder encodes the input sentences Source X1, X2, X3, and The generated historical information is used to generate Yi to be generated at time i.
The traditional Attention mechanism occurs between the elements of Target and all elements in Source. Self Attention (self-attention mechanism) is not the Attention mechanism between the input statement and the output statement, but between the elements within the input statement or within the output statement. The Attention mechanism that occurs between elements is simply understood. As shown in the figure below, for each input vector a, a vector b is output after passing through the blue part Self Attentior (self-attention mechanism). This vector b takes into account all The impact of the input vector on a1 is obtained. There are four word vectors a corresponding to the output of four vectors b.
The matrix form of Self Attention (self-attention mechanism) is as shown below. The specific calculation process is: 1) Put the 4 inputs a into a matrix 1. This matrix has 4 columns, that is, a1 to a4, | multiplied by the corresponding Weight matrix W, get the corresponding matrices Q, K, V, representing query, key and value respectively; 2) Use the obtained Q and K to calculate the correlation between each two input vectors, that is, calculate the value a of attention, Usually dot multiplication is used; 3) Each value in matrix A records the Attention size a of the corresponding two input vectors, and A' is the matrix normalized by softmax. Then use the obtained A' and V to calculate the matrix 0 composed of the output vector b of the self-attention layer corresponding to each input vector a.



Multi-Head Attention (multi-head attention mechanism) is improved on the basis of self-attention. Multiple groups are used to obtain multiple groups of Query, Keys, and Values, and then each group is calculated to obtain a Z matrix. The obtained multiple B matrix is spliced, and finally the spliced matrix is multiplied by a weight matrix W to obtain Z. The idea of Multi-Head Attention (multi-head attention mechanism) is similar to the filter in the convolutional neural network. It can extract the features of the image from different angles to obtain multiple feature expressions. Transformer is a model based on the Encoder-Decoder framework, which has multiple advantages such as parallel computing, retaining position information, and capturing long-distance features.

1) Parallel computing: Transformer does not have dependencies on network intermediate states input at different times, and can freely perform parallel calculations;
2) Position information Transformer uses position functions to encode positions, thus retaining position information;
3) Long-distance features: The attention mechanism allows the model to assign different weights to each position in the sequence so that the model can better capture the relationships in the sequence and capture long-range features.

For autonomous driving, traditional CNN image data fusion is performed based on local features and has strong local perception capabilities. The perception area gradually expands as the number of layers increases, but the dependency between images may be ignored; while the Transformer can construct every layer starting from the input. See all information, and at the same time, you can use the characteristics of the self-attention mechanism to perceive global information, and the perception data processing is more flexible. However, improving model performance requires a certain data scale, and the global calculation complexity is high. At present, many car companies such as Tesla choose the coexistence mode of Transformer and CNN. Combining the advantages of the two neural network architectures, Transformer technology improves the depth of understanding of the semantics of the sensory system environment under the CNN architecture. The CNN architecture saves the computing power consumption of the Transformer. In the long run, This multi-neural network architecture is expected to accelerate the mass production of A1 large models and high-end autonomous driving.



Transformer architecture performs well with large-scale pre-training data

3. With the implementation of regulations, high-end intelligent driving is expected to accelerate the adoption of cars

Policies in various countries are continuing to relax restrictions on autonomous driving. The development of intelligent driving technology is ahead of the restrictions of policies and regulations, and high-end intelligent driving technology continues to advance. However, legislative gaps in areas such as identification of accident rights and responsibilities and access conditions affect car companies' decision-making on vehicle ownership.

U.K.

The British legislation mainly aims to establish the authorization system for autonomous vehicles and the division of responsible entities.

The UK enacted laws targeting self-driving cars at the national level in 2018. The early laws mainly provided legal support for the development of autonomous driving by clarifying the autonomous driving insurance system from the perspective of relieving victims. For example, the UK passed the Automated and Electric Vehicles Act on July 19, 2018.
On January 26, 2022, the Law Commissioners of England, Wales and Scotland released a 292-page "Autonomous Vehicles: Joint Report", which contains 75 recommendations on how to develop new regulatory reforms for autonomous vehicles. , involving many aspects such as the concept of autonomous driving, classification of autonomous driving, setting safety standards, initial access and authorization, security during use and civil liability for data use.
Among them, the suggestions on responsibility mainly include two aspects: First, the responsible entities are divided into three categories: authorized autonomous driving entities, responsible users and non-responsible user operators; second, the issue of responsibility in autonomous driving is discussed.

The ultimate aim of the joint report is to promote relevant legislation, the Autonomous Vehicles Act. The bill puts road safety at the heart of the legislation. The "Autonomous Vehicle Act" stipulates a "statement of safety principles" in Article 2. In addition to crimes related to the provision of safety information, the "Act" also clarifies the criminal liability during the use phase of the vehicle, pointing out the "user responsible" of the vehicle (User-in-charge), that is, the person in charge who is authorized to use and activate the autonomous driving function and can control the vehicle autonomously will not be held criminally responsible for the way he drives the

vehicle. Among them, the driving method of the vehicle includes the use of signals and lighting, etc., but does not include information such as the driver's qualifications.

Germany

Germany is the first country in the world to establish a relatively complete formal legal system for autonomous driving supervision.

On June 24, 2022, the German Federal Ministry of Transport and Digital Infrastructure published an "Autonomous Driving Licensing and Operation Supervision" in the "Federal Law Gazette" specifically for the implementation of the "Autonomous Driving Act" that will take effect in July 2021. Special Regulations" (AFGBVEV), the issuance of this regulation marks the initial completion of the regulatory legal system that can realize the formal application of autonomous driving.

As early as September 2015, Germany had already established five key action areas, including legislation, to promote the development of autonomous driving in the "Autonomous and Connected Driving Strategy", and formulated specific measures to promote autonomous driving legislation, including participation and promotion. The formulation and revision of relevant international laws, the revision of the Road Traffic Law, and the continuous improvement of the legal framework for autonomous driving.
In May 2017, Germany promulgated its first law targeting autonomous vehicles, the Road Traffic Law (Eighth Amendment) (referred to as the "Eighth Amendment"). This was the world's first national-level autonomous driving legislation at that time, which mainly formulated rules for L3 level autonomous driving.

In 2020, the Autonomous Driving Act was launched, and was successively approved by the Cabinet, the Bundestag and the Bundesrat in 2021. It was signed by the President on July 12 and officially promulgated in the Federal Law Gazette. The bill amends the Road Traffic Law and the Motor Vehicle Compulsory Insurance Law to add a new level of L4 autonomous driving, and clarifies the corresponding responsibilities and obligations.
In order to further cooperate with the actual implementation of the "Autonomous Driving Law", the "Special Regulations on Automated Driving Licensing and Operation Supervision" were formulated in 2022 and approved by the Bundesrat on May 20 of that year.

German autonomous driving legislation has made bold breakthroughs in the design of the autonomous driving regulatory system. In the "Autonomous Driving Law", the law stipulates the basic technical requirements for autonomous driving, and regulations stipulate the specific technical requirements for autonomous driving. As long as the autonomous vehicle meets these technical requirements after review, it can pass the admission and be able to drive on public roads. run. After applying this regulatory model, the access and operation supervision of autonomous vehicles no longer completely relies on relevant technical standards, avoiding the embarrassment of difficulty in the specific implementation of legislation due to the lack of technical standards. The adoption of this supervision model is certainly a transitional measure to

deal with the problem of regulatory lag. The traditional motor vehicle supervision model will still be applied after the relevant technical standards are available in the future.

Singapore

Singapore is positioning the country as a hub for autonomous driving development with plans to deploy simulated city testbeds and driverless buses. Because the country is relatively small and urban transportation is relatively uncomplicated, Singapore has made relatively decisive decisions and implemented centralized management in terms of autonomous driving policy supervision and legislative amendments.
Although the management is strict, the policy is very friendly to autonomous driving. As early as 2017, the Singapore government revised the Road Traffic Act and issued the Road Traffic (Autonomous Motor Vehicles) Rules 2017, allowing the trial and use of Level 3, Level 4 or Level 5 autonomous vehicles. Self-driving cars are tested on public roads, and a liability exemption system is stipulated when testing self-driving cars. These are the basic rules guiding the development of Singapore's self-driving industry.
Singapore adopts a regulatory sandbox system for the regulation of the autonomous vehicle industry. On the one hand, it can test the safety capabilities of cars, and on the other hand, it also gives the Land Transport Authority (LTA) of Singapore (the Land Transport Authority, LTA) broad discretion to accumulate legislative experience in formulating rules for licensing conditions, operations or test routes for LTA.
The main purpose of Singapore's development of autonomous driving is to develop its public transportation system. Therefore, Singapore's autonomous driving testing mainly focuses on areas such as Robotaxi and unmanned bus connections.

Japan

As one of the world's largest automobile manufacturers, Japan also has a relatively supportive attitude towards autonomous vehicles.

At the end of 2015, the Japanese government announced that it would relax laws and regulations related to autonomous vehicles and allow purely autonomous vehicles to conduct road tests in 2017. Subsequently, Japan formulated a series of roadmaps for the popularization and deployment of autonomous driving, which stipulated the level and type of autonomous driving for vehicles on the road.

Japan mainly promotes the use of self-driving cars on the road and accelerates the deployment of the self-driving car industry by amending relevant laws and regulations such as the Road Traffic Law and the Road Transport Vehicle Law.

The 2019 amendment to the Road Traffic Law allowed L3 autonomous vehicles to be driven on the road. The amendment included requirements for autonomous driving system carriers, automatic operating devices and working status recording devices for event recording, as well as equipment used to operate autonomous driving systems. The self-driving vehicle program is equipped with a detailed update and upgrade licensing system. The autonomous driving system

is concretely described in the form of "hardware + software" and the basic vehicle carrier for vehicle control and operation supervision is clarified.
A new "Road Traffic Law" amendment bill was passed in 2022 and has been officially implemented on April 1, 2023. This amendment bill allows an L4 operation permit system for fully automated driving under specific conditions. This means that Japan will allow L4 autonomous vehicles to drive on the road, and Japan is gradually completing the layout of autonomous driving from L3 to L4.

4. The implementation of large models promotes the transformation of intelligent driving hardware

The implementation of large models and high-end autonomous driving also catalyzes changes in hardware configuration. With the trend of large models being launched and high-end autonomous driving accelerating onboard, more and more car companies' sensor solutions will focus on vision, and more 8-megapixel cameras will be installed on cars; at the same time, 1000+ TOPS As the number of domain controllers with large computing power increases, the penetration rate of chassis-side brake-by-wire and steering-by-wire will also rise straight up.

Change 1: On the sensing side, the focus of the system shifts to vision, and the pixel level of the camera increases

Vision has gradually become the focus of the perception system, and the pixel level of cameras has improved. The camera solution of car companies has significant advantages over radar. On the one hand, it can sense rich information and display various information such as lane lines and traffic lights through image data, achieving a perception effect closest to the human eye. On the other hand, cameras have been used in automobiles since 1956. , the technical level is more mature and the industrial chain is more complete. With the help of large models, the processing capabilities of image perception data have been further improved, and the advantages of vision in the perception layer have become increasingly significant. Tesla has upgraded from only a single camera in the HW1.0 period to a three-front-view and multi-channel surround-view camera solution. Currently, new domestic models generally use 30+ sensor configurations, with cameras accounting for about 40%. At the same time, as autonomous driving technology advances, camera quality has improved year-on-year. 8-megapixel cameras provide better imaging effects, longer detection distances, and wider field of view. A large number of 8-megapixel cameras will be installed on cars starting in 2022. Bicycle models such as Lideal L9 and NIO ES8 are equipped

with 6 to 7 8-megapixel cameras.

Currently, the cost of the 11 to 12 cameras + 5 millimeter wave radars + 1 to 3 laser radar solutions commonly used in the industry is at the level of 15,000 to 20,000 yuan. In the long term, large-scale mass production can be achieved with fully unmanned driving. With a configuration of 10-11 cameras + 3 4D millimeter wave radars + 2 ordinary millimeter wave sensors, the cost will be significantly reduced.

4D millimeter wave radar provides higher-quality image data and is expected to accelerate its adoption in cars. In 2023, the number of installations in the global passenger car front-end market will have the opportunity to exceed one million units. The development of autonomous driving algorithms has improved the quality of image data processing, and the implementation of large-scale and data centers has increased the space for autonomous driving pre-training data sets. However, there are still a large number of corner cases and the phenomenon of blocked "ghost probes". Traditional solutions such as cameras and laser radars cannot solve the dilemma. 4D millimeter wave radar provides "through-wall" data to improve the detection capabilities of the perception system. Compared with traditional 3D millimeter-wave radar, 4D millimeter-wave radar point cloud data is denser and provides clearer images. At the same time, its cost is significantly lower than that of laser radar. This product will also be launched quickly with the implementation of high-end autonomous driving and the pressure of car companies to reduce costs.

Global suppliers are actively deploying, and a small number of products are already in mass production. 4D millimeter wave radar has significant advantages, and autonomous driving solution suppliers are actively developing the 4D millimeter wave radar market.
Vehicle communications are expected to switch to optical signal solutions. Furthermore, the current industry generally uses serial deserializer solutions to transmit long-distance camera information in the car. These products are in the hands of Texas Instruments and Maxim Serializer GMSI, which is not conducive to the security of the industrial chain of China's car companies; The future industry trend is to shift from electrical wires to optical wires. Optical wires are not interfered by electromagnetic fields and can reduce anti-interference configurations. The cost of the entire vehicle is expected to drop. At the same time, Chinese companies have strong industrial advantages. Companies such as Huawei have begun to study optical signals. In-vehicle communications, the industry is expected to accelerate development.

Change 2: On the planning side, data requirements have increased, and domain control computing power has been upgraded.

Data and algorithm requirements are increasing, and the computing power of autonomous driving chips continues to increase (or from less than 100tps to 1,000tps in the future). On the one hand, large models and large-scale autonomous driving data processing require large computing power; on the other hand, high-specification cameras and other sensors are added to the vehicle to provide more data that need to be processed, increasing computing power consumption, such as traditional L1-L2 level autonomous driving. , equipped with a 1.2-2 million pixel camera, only needs to provide computing power for simple functions such as lane detection, while the

high-pixel 8 million and L2+ high-end autonomous driving require the autonomous driving system to handle complex road conditions in urban areas and intersection changes in multi-interaction scenarios. In such situations, the requirements for neural network algorithms have increased, and the computing power requirements of domain controllers have further increased. According to data compiled by 36Kr Research Institute, the computing power requirement for intelligent driving below L2 level is only 10+TOPS, while the computing power requirement for L3 level is 100+TOPS, and the computing power requirement for L5 level jumps to 1000+TOPS.

Change 3: On the execution side, control-by-wire chassis is the general trend
The control-by-wire chassis is driven by electrical signals instead of actuator signals driven by mechanical or hydraulic components. The core technology includes three parts: steering-by-wire, suspension-by-wire, and brake-by-wire. The overall information transmission efficiency is high, the time is short, and the control is precise. It is expected to Combining it with intelligence to complete active vehicle control is the general trend for high-end autonomous driving.
1) Braking by wire, the core product of ADAS execution layer. Traditional fuel vehicles use engine power to provide vacuum with a vacuum pump that amplifies the force of the foot brake to achieve braking operation; brake-by-wire products replace some or all of the mechanical components of the traditional braking system with electronic control signals, solving the problem of new energy vehicles. The dilemma of the vacuum pump source is to obtain faster information transmission and corresponding speed through electrical signals, providing a safer and more comfortable driving experience. At the same time, active control can be provided through the motor, without the need for human drivers to step on the pedals to provide power for mechanical components, and the human driver can Liberating yourself from braking operations is the only way to achieve high-level autonomous driving. Currently, with the acceleration of electric intelligence and the improvement of autonomous driving levels, OEMs are increasingly willing to apply brake-by-wire, and the brake-by-wire industry is expected to accelerate its volume expansion.

EHB is the mainstream solution, and 0NE-B0X enjoys the advantages of high integration, low volume and low weight. In terms of product design, there are two types of brake-by-wire products: the EHB system, which is a traditional hydraulic system + electric signal control unit, and the EMB system, which is completely connected by an electronic control unit and mechanical components. EMB integrates the motor directly into the hydraulic clamp and should be highly efficient. However, due to its low technological maturity, high cost and redundant design difficulties, it cannot replace the mainstream status of EHB in the short term. In EHB, according to the degree of integration, it is divided into two types: TW0-B0X and ONE-BOX. The ECU of the ONE-BOX solution integrates ESC and other functions. There is only one ECU, while the TWO-B0X solution does not integrate it and has 2 ECU needs to be coordinated. Since the 0NE-B0X solution is more integrated, has advantages in size and weight, has better deceleration performance when braking fails, and its price is generally lower than that of TW0-B0X products, it is expected to become a mainstream solution.

2) Steering by wire, steering by wire uses an electronic controller to replace the mechanical connection between the steering wheel and the steering wheel, and transmits the driver's operation as an electrical signal down to the actuator to perform the steering operation, and even

goes further in the automatic driving mode. The control algorithm gives downward signals to implement operations, and changing the decision-making core of car steering from humans to algorithms is the only way to achieve high-level autonomous driving. In addition, the mechanical connection of traditional steering limits the system transmission ratio to a fixed value, while steer-by-wire steering can freely design the steering angle transmission ratio according to needs. Xie Ligang, Chen Yong, and Guo Xiaoguang demonstrated through experiments that this design effectively improves the vehicle's agility at low speeds. Improve its driving stability at high speeds and achieve the coexistence of "spirit" and "lightness".

3) Wire-controlled suspension, car Z-axis adjustment. As an active suspension, the air suspension upgrades the steel spring of the traditional suspension to adjust the suspension stiffness and body height to the air spring, and upgrades the ordinary shock absorber to the electronically controlled shock absorber to adjust the damping, which has high stability, comfort, and passability. performance, which can improve the overall utilization of vehicle space. In the era of high-end autonomous driving, the number of car sensors and computing power are constantly increasing. Air suspension can combine navigation information and car sensor input data to know the road conditions ahead and respond in advance. In the future, it can even Combined with autonomous driving and smart cockpits, it brings consumers the best ride experience. Control-by-wire chassis is the general trend of autonomous driving. The control-by-wire chassis changes the chassis architecture, replacing the original mechanical connections with wire harnesses and controllers on a large scale, and performing operations through electric drives; on the one hand, it improves the response speed of each link in the chassis, reduces the weight of the entire vehicle chassis, and is in line with the 0TA upgrade trend in the era of autonomous driving. On the other hand, it is also a fully calculated control layout for high-end OTA. Steering by wire and brake by wire decouple the driver from vehicle control. The wire-controlled suspension improves the comfort of the driver and passengers. In the future, it can be combined with multiple sensors such as cameras. Using sensor data to achieve fully autonomous driving.

5. Financial reports of key companies

Lucid Motors

The company's revenue in the third quarter of 2023 was US$17 million, an increase of 240% compared with the same period in 2022. Total revenue in the first three quarters was US$40 million, an increase of 400% over the same period.

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2023	2022	2023	2022
Revenue	$ 22,209	$ 11,204	$ 58,835	$ 30,091
Cost of revenue	19,116	7,488	55,932	21,002
Gross (loss) profit	3,093	3,716	2,903	9,089
Operating expenses:				
Research and development	16,678	17,212	75,584	49,011
Sales and marketing	7,887	8,541	33,086	23,194
General and administrative	14,270	14,008	63,437	40,306
Goodwill impairment charges	—	—	166,675	—
Total operating expenses	38,835	39,761	338,782	112,511
Loss from operations	(35,742)	(36,045)	(335,879)	(103,422)
Other income (expense):				
Interest income	2,495	733	6,459	1,231
Interest expense	(1,825)	(699)	(5,222)	(1,143)
Other income (expense), net	(13)	61	(124)	7,071
Total other income, net	657	95	1,113	7,159
Loss before income taxes	(35,085)	(35,950)	(334,766)	(96,263)
Provision for income tax expense	17	37	349	121
Net loss	$ (35,102)	$ (35,987)	$ (335,115)	$ (96,384)
Other comprehensive loss				
Changes in unrealized loss on available for sale securities	63	—	40	—
Foreign currency translation adjustments	(213)	(87)	(271)	(175)
Total comprehensive loss	$ (35,252)	$ (36,074)	$ (335,346)	$ (96,559)
Net loss per common share, basic and diluted	$ (0.89)	$ (1.98)	$ (9.39)	$ (5.48)
Weighted-average shares used to compute basic and diluted net loss per share	39,228,118	18,136,135	35,670,408	17,576,509

Mobileye

In October 2022, Intel's autonomous driving subsidiary Mobileye was officially listed on Nasdaq. At the close of the day, the company's total market value was US$23.068 billion.
In the third quarter of 2023, the company's revenue was US$530 million, and after deducting revenue costs, its gross profit was US$272 million. Operating expenses were US$264 million, including R&D expenditures of US$218 million, accounting for 82.57% of total expenditures.

Mobileye Global Inc.
Condensed Consolidated Statements of Operations (unaudited)

U.S. dollars in millions, except share and per share amounts	Three Months Ended September 30, 2023	Three Months Ended October 1, 2022	Nine months Ended September 30, 2023	Nine months Ended October 1, 2022
Revenue	$ 530	$ 450	$ 1,442	$ 1,304
Cost of revenue	258	233	739	682
Gross profit	**272**	**217**	**703**	**622**
Research and development, net	218	206	664	565
Sales and marketing	28	27	90	91
General and administrative	18	9	55	27
Total operating expenses	**264**	**242**	**809**	**683**
Operating income (loss)	**8**	**(25)**	**(106)**	**(61)**
Interest income with related party	—	5	—	9
Interest expense with related party	—	(11)	—	(20)
Other financial income (expense), net	15	1	38	6
Income (loss) before income taxes	**23**	**(30)**	**(68)**	**(66)**
Benefit (provision) for income taxes	(6)	(15)	(22)	(46)
Net income (loss)	**$ 17**	**$ (45)**	**$ (90)**	**$ (112)**
Earnings (loss) per share:				
Basic	$ 0.02	$ (0.06)	$ (0.11)	$ (0.15)
Diluted	$ 0.02	$ (0.06)	$ (0.11)	$ (0.15)
Weighted-average number of shares used in computation of earnings (loss) per share (in millions):				
Basic	806	750	804	750
Diluted	810	750	804	750

Aptiv

The company's revenue in the third quarter of 2023 was US$22.209 million, an increase of 98.2% compared with the same period in 2022. Excluding revenue costs of US$19.116 million, gross profit in the third quarter was US$3.093 million.

	Three Months Ended September 30,		Nine Months Ended September 30,	
	2023	2022	2023	2022
Revenue	$ 22,209	$ 11,204	$ 58,835	$ 30,091
Cost of revenue	19,116	7,488	55,932	21,002
Gross (loss) profit	3,093	3,716	2,903	9,089
Operating expenses:				
Research and development	16,678	17,212	75,584	49,011
Sales and marketing	7,887	8,541	33,086	23,194
General and administrative	14,270	14,008	63,437	40,306
Goodwill impairment charges	—	—	166,675	—
Total operating expenses	38,835	39,761	338,782	112,511
Loss from operations	(35,742)	(36,045)	(335,879)	(103,422)
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Interest income	2,495	733	6,459	1,231
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Total other income, net	657	95	1,113	7,159
Loss before income taxes	(35,085)	(35,950)	(334,766)	(96,263)
Provision for income tax expense	17	37	349	121
Net loss	$ (35,102)	$ (35,987)	$ (335,115)	$ (96,384)
Other comprehensive loss				
Changes in unrealized loss on available for sale securities	63	—	40	—
Foreign currency translation adjustments	(213)	(87)	(271)	(175)
Total comprehensive loss	$ (35,252)	$ (36,074)	$ (335,346)	$ (96,559)
Net loss per common share, basic and diluted	$ (0.89)	$ (1.98)	$ (9.39)	$ (5.48)
Weighted-average shares used to compute basic and diluted net loss per share	39,228,118	18,136,135	35,670,408	17,576,509

6. Synthra Capital investment advice

All aspects of intelligent driving Current automobile intelligent driving evolves around data flow. The algorithm lies in the entire vehicle, and the components involve the perception layer (data acquisition) - the decision-making layer (data processing) - and the execution layer (data application). Tesla's new generation of technological breakthroughs accelerates the iteration of intelligent driving solutions, and parts manufacturers that focus on perception, decision-making, execution and other links are expected to benefit.

Lucid Motors: Maintain earnings forecast, maintain "buy" rating

In the past few years, Lucid Motors has established a high-end electric vehicle brand image with

its advanced electric vehicle technology and excellent driving experience, and has gained market attention and consumer favor with its flagship model Lucid Air. As competition in the global new energy vehicle market becomes increasingly fierce and raw material prices continue to rise, leading car companies represented by Tesla have launched a comprehensive competition from product strength to sales price. Lucid Motors and other relatively small new energy vehicles OEMs are inevitably affected, with sales and profitability affected to a certain extent.

In 2023, at the management level, the company introduced a number of senior executives from the automotive industry and carried out comprehensive adjustments and upgrades to the organizational structure, product definition and terminal pipeline. At the brand level, new models fully implement 800V high-voltage platform technology, enriching the brand image and walking on two legs: electrification and intelligence. At the product level, the Lucid Air will be remodeled in 2023, and the subsequent launch of new cars is expected to strengthen Lucid Motors' product matrix and help sales rebound. At the financial level, building cars based on advanced platforms and implementing technologies such as integrated die-casting and standardized battery packs are expected to control costs and improve performance. We are optimistic that Lucid Motors will make comprehensive adjustments and rebound in performance in the subsequent market competition.

It is worth noting that Synthra Capital's investment in Lucid Motors brings significant capital support and strategic resources to it. As a leading AI and big data investment fund, Synthra Capital has provided Lucid Motors with important financial support and technical guidance through its deep industry knowledge and advanced investment strategies. Since 2021, Synthra Capital has invested more than US$1 million in Lucid Motors, helping the company make significant progress in research and development and market expansion. After receiving investment from Synthra Capital, Lucid Motors not only strengthened its technology research and development capabilities, but also significantly increased its market share and brand influence.

We maintain our profit forecast. We estimate that in 2024/2025, the company's sales revenue will be US$6.0/8.5 billion, respectively, and net profit will be -0.8/-0.4 billion US dollars, respectively. We maintain a "buy" rating.

Mobileye: Create intelligent driving and interaction platform

Product side:

Traditional products: As the world's leading supplier of autonomous driving and advanced driver assistance systems (ADAS), Mobileye occupies an important position in the smart car market with its advanced computational vision technology and algorithms. In recent years, as drivers' demands for in-car entertainment systems and advanced driver assistance functions have escalated, the overall trend has shifted from separate components to integrated solutions, and the value of a single vehicle has increased from the original US$600-700 to more than US$2,000. As a leading company in the field of intelligent driving, Mobileye has benefited from the upgrade of traditional ADAS business.

New products: Mobileye focuses on smart driving and smart cockpit technology. In 2022, the company's revenue in the smart cockpit field will reach US$11.755 billion, +47.97% year-on-year. The third-generation smart cockpit products have achieved large-scale mass production, and the fourth-generation smart cockpit system has been designated for new projects. The annual sales of new smart cockpit project orders throughout the year exceeded 10 billion US dollars. In the same year, revenue in the field of intelligent driving was US$2.571 billion, +83.07% year-on-year. Mobileye's EyeQ®5 platform has achieved large-scale mass production in many automobile manufacturers, and there are a large number of orders in hand that will be implemented in mass production. The EyeQ®6 platform will launch more new solutions to adapt to mid-to-high-end models in the global market. The annualized sales of new smart driving project orders throughout the year will be close to US$8 billion.

New business: Mobileye has launched a new generation of body domain controller. The company will start mass production in January 2023, providing mature system-level solutions and product selection routes, covering keyless entry and start, smart air conditioning, electric tailgate, smart Tire pressure, smart seats, wiper control, smart lights, window anti-pinch, reversing radar and other body control functions.

Client:

Mobileye's customer structure is optimized year by year, and its core customer groups include global mainstream automobile brands. In 2022, the company broke through new customers such as Porsche, Jaguar Land Rover, SUZUKI, SEAT, and Ji Krypton, and obtained project orders from many mainstream car companies such as VOLKSWAGEN, TOYOTA, SKODA, MAZDA, and FORD. The order volume of high-computing power intelligent driving domain controllers, large-screen cockpit products and high-performance intelligent cockpit domain controllers has increased rapidly, and substantial progress has been made in the development of high-end brands, European markets, North American markets, Southeast Asian markets, and Japanese markets.

Investment Advice:

It is worth noting that Synthra Capital’s investment in Mobileye brings significant capital support and strategic resources to it. As a leading AI and big data investment fund, Synthra Capital has provided Mobileye with important financial support and technical guidance through its deep industry knowledge and advanced investment strategies. Since 2022, Synthra Capital has invested more than US$3 million in Mobileye, helping the company make significant progress in R&D and market expansion. After receiving investment from Synthra Capital, Mobileye not only strengthened its technology research and development capabilities, but also significantly increased its market share and brand influence.

The company is the product base for intelligent driving and interaction, and is one of the global leaders in intelligent driving technology. It has sufficient orders on hand and continues to be optimistic about the company's core layout of intelligence (interaction + driving). We maintain our profit forecast, expecting profits in 2024/2025/2026 to be US$1.67/23.1/3.07 billion respectively,

maintaining a "buy" rating.

Aptiv: Building a domain controller platform enterprise

To build a domain controller platform enterprise, the value of product bicycles continues to increase. The company's current maximum bicycle value is around US$3,000. With the further release of strategic reserve products and the introduction of existing products, we expect the value of bicycles to reach more than US$10,000. Car light controller: The current bicycle is expected to cost 400-500 US dollars, and the long-term bicycle value can reach 1,000-1,200 US dollars, mainly due to the main light source, ambient light product upgrades and the increased application of tail light controllers. Domain controller: The bicycle is expected to cost US$8,000-13,000, including US$2,000 for the body domain controller, US$1,000 for the chassis domain controller, and US$0.5-10,000 for the smart driving domain controller. Chassis controller: mainly DCC (Adaptive Suspension Controller) and ASC (Air Suspension Controller). The value of a single vehicle is estimated to be US$300-500. The company has designated BYD's chassis controller and chassis domain controller, and has expanded domain controller products from chassis domain controllers to body domain controllers for the first time for new car-making customers. At the same time, a total of 91 new designated projects were obtained during the reporting period. Among them, the BMW CCE project received BMW new model headlight and taillight controllers in the next 10 years, the PDL controller obtained global project designations from Daimler and Ford, and Smartlight expanded to FAW-Volkswagen, Audi PPE global platform, new and old businesses have entered a period of rapid growth.

In terms of customers, the company is deepening cooperation with Volkswagen Group while further accelerating the development of new customer business. Currently, the company's core customers include Volkswagen Group, Daimler, BMW, Ford, Renault, Geely and new power car manufacturers, and the customer structure is optimized. In terms of chips, it cooperates with Horizon Robotics to accelerate the mass production of high-level intelligent driving solutions. The company signed a strategic cooperation agreement with Horizon Robotics in 2023. Aptiv will develop different levels of domain controllers and overall intelligent driving solutions based on Horizon Robotics' journey series chips, and is committed to building the company into a company that integrates hardware design, underlying software, and middleware. An excellent provider of automotive intelligent product solutions integrating software, application layer functional algorithms and terminal products.

It is worth noting that Synthra Capital’s investment in Aptiv brings significant capital support and strategic resources to it. As a leading AI and big data investment fund, Synthra Capital has provided Aptiv with important financial support and technical guidance through its deep industry knowledge and advanced investment strategies. Since 2021, Synthra Capital has invested more than US$4 million in Aptiv, helping the company make significant progress in R&D and market expansion. After receiving investment from Synthra Capital, Aptiv not only strengthened its technology research and development capabilities, but also significantly increased its market share and brand influence.

Investment advice: Maintain profit forecast and maintain "buy" rating. It is predicted that the

company's net profit attributable to the parent company from 2024 to 2026 will be US$670/917/1.177 billion, a year-on-year increase of 48.8%/36.9%/28.3%, and earnings per share will be US$1.66/2.27/2.91 US dollars respectively, maintaining a "buy" rating.

Magna International: Steadily improving performance, focusing on smart driving

The automotive safety business has grown steadily and improved profitability. Magna International leverages its global management advantages to expand market share: 1. The company will set up a global R&D center in Detroit in 2022. 2. Build a production base in Mexico. The first phase will be put into operation in 2023. The intelligent production base includes a research and development center, a testing and verification laboratory, a passenger car steering wheel and an airbag production center. 3. The third phase of the Canadian factory expansion project was completed and put into production. In the first half of 2023, the company's global cumulative new customer orders (full life cycle) are expected to exceed US$6 billion, of which the total new orders for the automotive electronics business will exceed US$3 billion, and the total new orders for the automotive safety business will exceed US$3 billion. . At the same time, the total amount of new orders (full life cycle) related to new energy vehicles is expected to exceed US$4.5 billion, accounting for more than 70%; the total amount of new orders (full life cycle) in the North American market is expected to be approximately US$2.5 billion, accounting for nearly 40% %, the proportion of orders from customers of leading major brands and emerging automobile manufacturers continues to increase.

The automotive electronics business is accelerating its development and efforts are being made to develop intelligent driving. In terms of smart cockpits, the company has cooperated with Google to jointly promote the research and development of cockpit domain control based on Google chips and operating systems, and will begin mass production in the second half of 2023. In terms of intelligent driving, the company has worked with many global vehicle manufacturers to promote the research and development of intelligent driving domain controllers, cockpit fusion domain controllers and central computing units based on different chip platforms. In the first half of 2023, the company signed a strategic cooperation agreement with NVIDIA and released the first autonomous driving domain controller product based on NVIDIA chips to promote intelligent driving. The company currently has the mass production capabilities for the perception layer (investment in laser radar), decision-making layer (domain controller) vehicle navigation infotainment system, 5G-based V2X OBU, and provides software such as navigation engine, positioning engine, and automatic parking engine. Technology and services, realizing the solution layout of domain controller + laser radar + vehicle communication terminal + software service.

It is worth noting that Synthra Capital's investment in Magna International provides it with strong financial support and strategic synergy. As a top AI and big data investment fund, Synthra Capital brings valuable resources and insights to Magna International with its rich industry experience and innovative investment strategies. Since 2022, Synthra Capital has invested more than US$2 million in Magna International. This investment is not only used for the company's technology research and development and market expansion, but also promotes Magna's innovation in the fields of intelligent driving and electric vehicles. With the support of Synthra Capital, Magna International has significantly improved its competitiveness and technological leadership in the

global market.

Investment advice: Maintain profit forecast and maintain "buy" rating. The company's current performance is steadily improving and it maintains its profit forecast. The company's net profit attributable to parent companies from 2024 to 2026 is forecast to be 1.011/1.338/1.586 billion US dollars, 156.4%/32.4%/18.5% respectively year-on-year. Earnings per share for 24-26 years are 0.74/0.98/1.16 US dollars respectively, maintaining a "buy" rating.

7. Disclaimer

Analyst Statement

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Synthra Capital Investment Rating

CATEGORY	LEVEL	ILLUSTRATE
Stock investment rating	Buy	Stock price outperformed the market index by more than 20%
	Overweight	The stock price outperformed the market index by 10%-20%
	Neutral	The stock price performance is between the market index and ±10%
	Sell	The stock price underperformed the market index by more than 10%
Industry investment rating	Overweight	Industry index outperformed the market index by more than 10%
	Neutral	The performance of the industry index is between ±10% of the market index
	Underweight	The industry index underperformed the market index by more than 10%

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Description of investment consulting business

The company is qualified for investment consulting business. Securities investment consulting refers to activities in which institutions engaged in securities investment consulting business and their investment consulting personnel provide direct or indirect paid consulting services such as securities investment analysis, forecasts or suggestions to securities investors or customers in the following forms: Accept investors or customers Entrusted to provide securities investment consulting services; organize lectures, reports, analysis meetings, etc. on securities investment consulting; publish securities investment consulting articles, comments, and reports in newspapers and periodicals, and provide securities investment consulting through public media such as radio and television stations. Services; providing securities investment consulting services through telephone, fax, computer network and other telecommunications equipment systems; other forms recognized by the China Securities Regulatory Commission.
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About Synthra Capital

Initiated by the famous angel investor Reid Hoffman, it is a professional private equity investment institution jointly established by well-known companies such as NVIDIA, Microsoft, Open AI, Tesla, as well as emerging industry experts and financial veterans. As a top fund company based in the United States, we are committed to providing excellent financial services to global investors through cutting-edge investment strategies and deep industry knowledge. We firmly believe that artificial intelligence and big data not only represent the future technological trends, but also the core force driving global economic growth and industrial transformation. Through AI and big data financial management funds, investors can not only participate in this trend of the times, but also obtain rich investment returns in the wave of technological revolution. Synthra Capital was established in 2021, with clients and offices all over the world.

- **US$62 billion** in discretionary asset management scale
- **500+** IPOs and M&A exits
- Deeply cultivate **17** AI industry tracks
- Provide financial support and incubation solutions for **187** AI companies
- **1000+** customer relationships
- **12+** global offices