Dahua AcuPick Technology White Paper

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Department: General Storage

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1 Foreword

With the rapid development of the intelligent cameras, cameras can provide a lot of intelligent data. To make the most efficient use of intelligent data to create value for users, Dahua has launched a fast and accurate search solution AcuPick. It uses the intelligent data captured by front-end cameras and the intelligent analysis ability of back-end devices to realize global and accurate search.

AcuPick extracts the features of a desired object present in a video stream with the help of the intelligent computing power of the front and back-end devices, and uses the features for channel search with high accuracy. Users only need simple operations to complete the target search, effectively improving the overall search efficiency and reducing the search cost. In addition, compared with the similar accurate search at the platform level, AcuPick has lower hardware cost and can adapt to a wider range of scenes. AcuPick features fast search, high accuracy, convenient use, and low cost.

With the rapid development of video surveillance, the current video search service faces the following challenges:

It takes a long time to extract information from massive video data

At present, the resolution of cameras is getting higher and higher, from 1080p, 4 MP, 8 MP, 12 MP to 64 MP (a single device), and the video data generated every day is massive. It takes a long time for security personnel or other users to find the desired information, such as a person and vehicle, from the massive video data. In an emergency, the best time to obtain results is probably missed.

The configurations of smart plan are complex, making it difficult for non-professional security users to use it.

The search efficiency can be improved through the pre-configuration of smart plan, the marking of intelligent data, and AI search after the event. However, for non-professional security users, the complicated configuration dissuaded some of them in advance.

The efficiency of ordinary intelligent search function is relatively low.

Based on perimeter functions such as SMD and IVS, timely alarm of events is more widely used. For event retrieval, because there is no metadata of the search object, it is still necessary to retrieve the specific object in hundreds or thousands of event logs. Therefore, the search time is long and the accuracy cannot be guaranteed.

Privacy security for intelligent face search.

With the development of deep learning in the video industry, face intelligence is also applied in the video industry. However, as it involves personal privacy issues, face intelligence cannot be widely used in many industries. Current Face-related retrieval services cannot effectively address the concerns of users.

Computing servers are expensive to use and difficult to popularize.

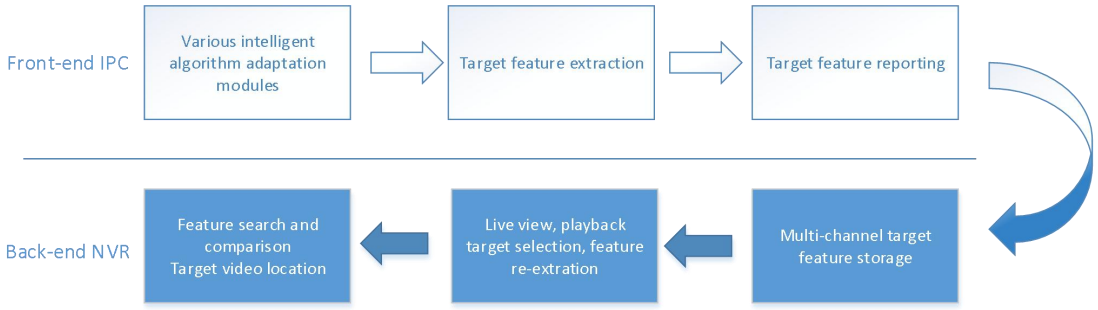
At present, there are some real-time and post-event retrieval solutions based on metadata in the industry, but the massive video metadata itself needs the support of powerful computing servers. The overall system architecture is complex, and the cost of

computing servers is high, which is unbearable for ordinary users. There are great challenges to the flexibility of storage capacity and computing power. Therefore, it is difficult to popularize as a general solution in all industries.

To meet the user's demand for fast and accurate search of objects in massive data and solve the above problems, Dahua has launched the fast and accurate search solution AcuPick based on years of experience in the development and exploration of intelligent services. AcuPick uses the intelligent data captured by front-end cameras and the intelligent analysis ability of back-end devices to realize global and accurate search of objects. AcuPick features fast search, high accuracy, convenient use, and low cost.

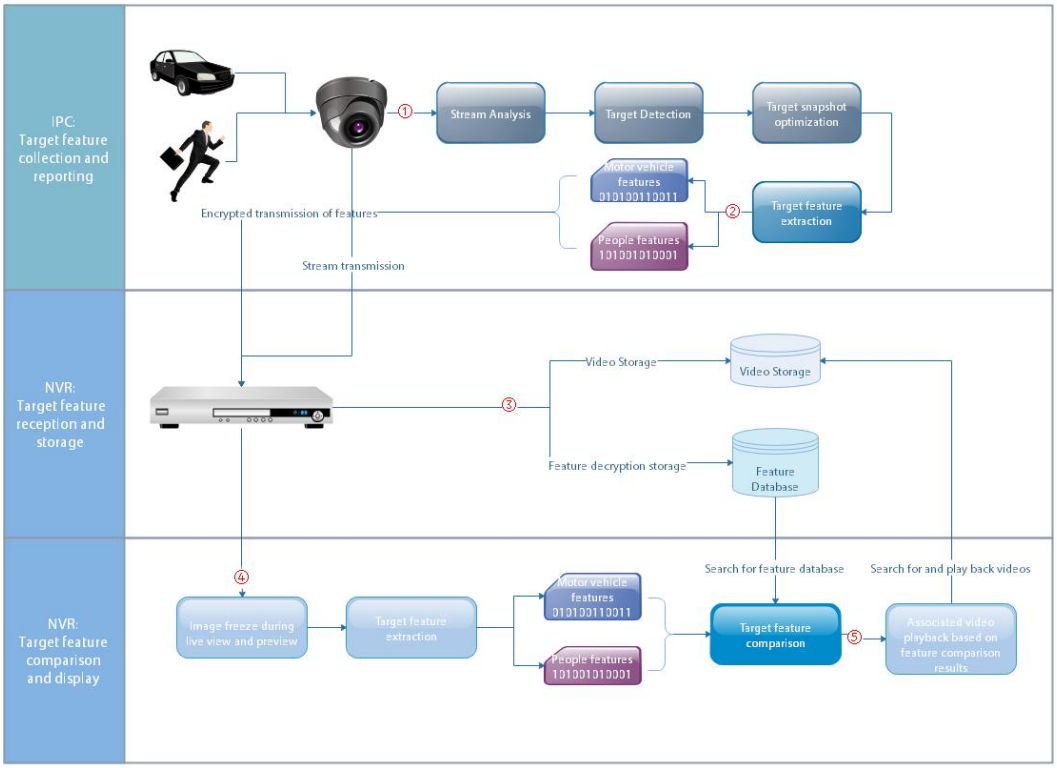
2 Introduction to AcuPick Technology

2.1 Technical Principles



Overall solution: Strong combination of front-end and Back-end devices

Combining the intelligent functions of both front-end and back-end products, Dahua AcuPick technology gives full play to the advantages of front-end and back-end products and integrates these advantages. From desired feature collection and reporting of IPC, and feature reception and storage of NVR, to outcomes comparison and display of NVR, it has built a set of mature and easy-to-use accurate search framework for users, to improve the video search efficiency.



The whole technical principle can be expounded from five parts (as shown in above figure):

① Front-end IPC: Collects the monitoring images, performs intelligent analysis of the stream in real time, and loads and matches the models and algorithms of different desired outcomes, including people and vehicles. When detecting a possible match, it will track it in real time, and performs optimized snapshot of the moving object to extract its optimal features and avoid the loss of details.

② Front-end IPC: Extracts the features of the optimized object, packages it into binary format, encrypts the feature data, and then transmit it to the back-end device. The object feature encryption method conforms to Dahua network security technical standards to ensure the data security.

For different objects, it extracts different types of features.

- People feature: Mainly contains appearance information of people, such as body shape, clothes color, clothes texture, hair style, and shoes style. AcuPick does not rely on the unique identity authentication information of people, such as face and other biometric information. When the external apparent features of people change, such as changing clothes, the accuracy of target feature comparison will be affected to some extent.
- Motor vehicle feature: Mainly contains the appearance information of motor vehicles, such as vehicle body color, model, annual inspection mark, and window appearance.

In addition, the detection effect is affected by factors such as illumination, posture and viewing angle. At the algorithm level, we have designed rich data enhancement strategies, optimized neural network structure and training strategies to improve the

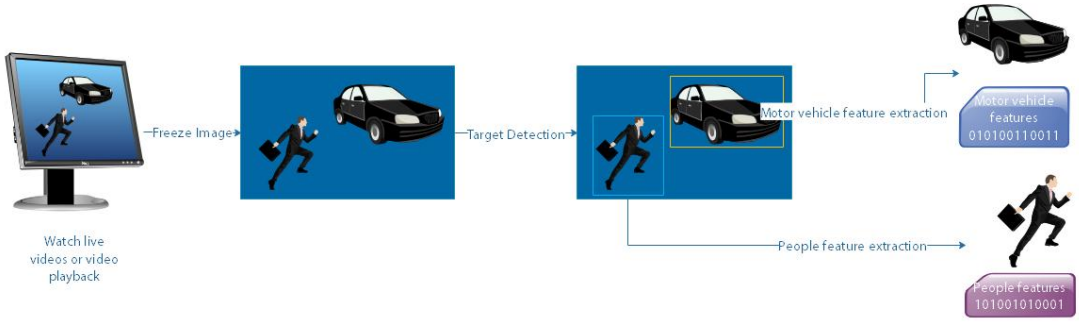
generalization and robustness of feature scenes, ensure accuracy, and reduce false and missed alarms.

At present, the model of feature extraction also has the following characteristics:

1) Image enhancement technology can effectively deal with the problems of image blur, occlusion and visual angle change.
2) Based on the progressive deep learning neural network model, the distinguishing features of the object can be effectively extracted.
3) Based on feature distillation and hash encoding technology, the model complexity and feature length are greatly reduced, which can realize rapid project deployment and fast search speed.
4) Without relying on face information, cross-view search of people can be realized.
5) The distributed hard sample mining technology is adopted, and the global features and local fine-grained features of the object are combined to effectively improve the robustness and resolving power of feature matching.

③ Back-end NVR: Receives and stores the front-end stream data in multiple channels in real time; binds the stream data with the channels and takes the system time as the correlation factor; synchronously receives the object feature data reported by the front-end IPC; uploads the object feature data to the database for comparison and search of features.

④ Back-end NVR: Freezes the video image where the object is located from the live or playback streams; automatically identifies the object type and position; starts the same model and algorithm as the front-end IPC to extract the features in the selected area (the feature information is the same as the description in the ② above); obtains the feature data to be compared and searched.

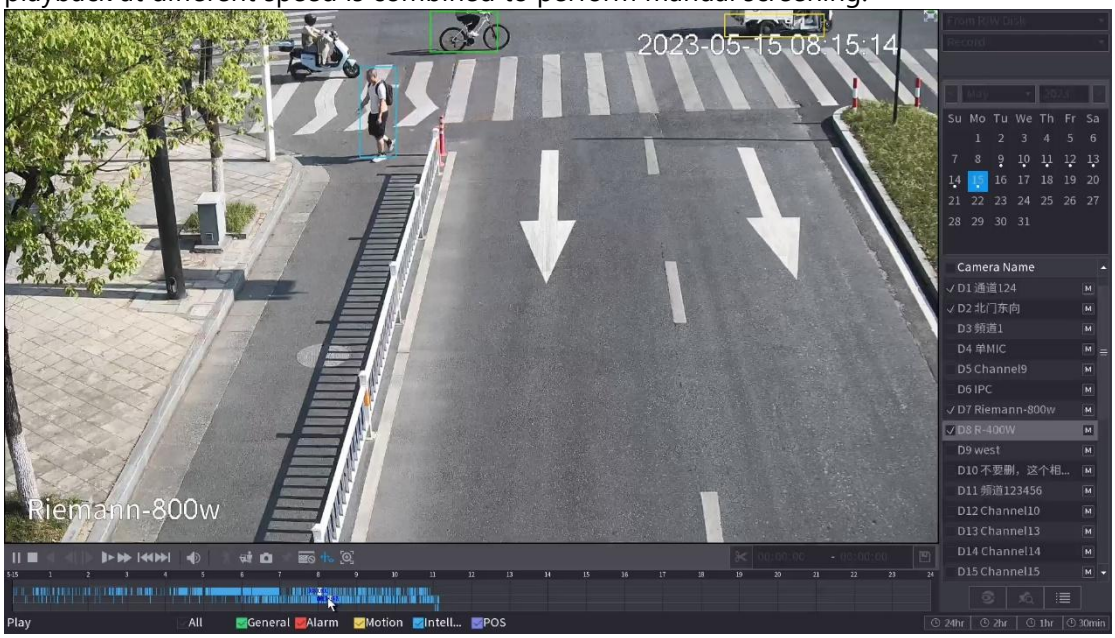


⑤ Back-end NVR: According to the channel and time, users can search for all the reported features of the object to be searched in the historical database, and performs feature comparison. Each group has two feature values (object feature to be compared and object feature that has been reported in history), and a similarity value is obtained after comparison. Similarity value is used to describe the matching degree of each group of outcomes, and the similarity value is sorted from high to low. The higher the similarity, the higher the matching degree of object features. Finally, according to the channel and time of the matched outcomes, the related video can be quickly located to achieve the purpose of accurate search.

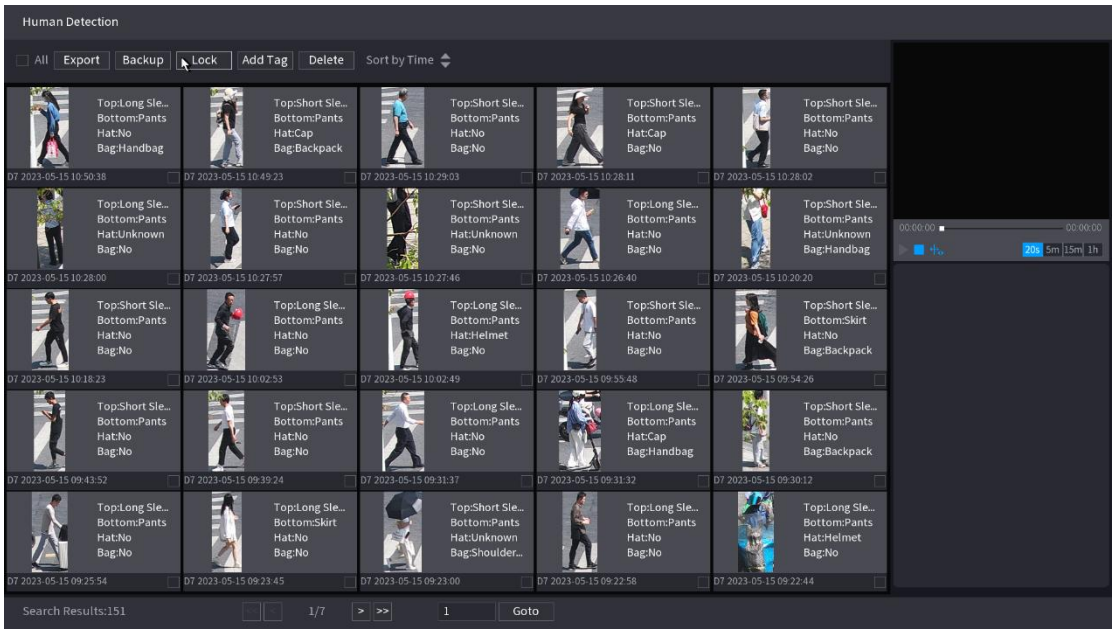
2.2 Application Values

Before AcuPick is used, the methods of searching for objects in all video clips of all associated channels are as follows.

Method 1: Based on the video playback of people and vehicle filtering of SMD, all the video clips containing the appearance and disappearance of objects are traversed. Video playback at different speed is combined to perform manual screening.

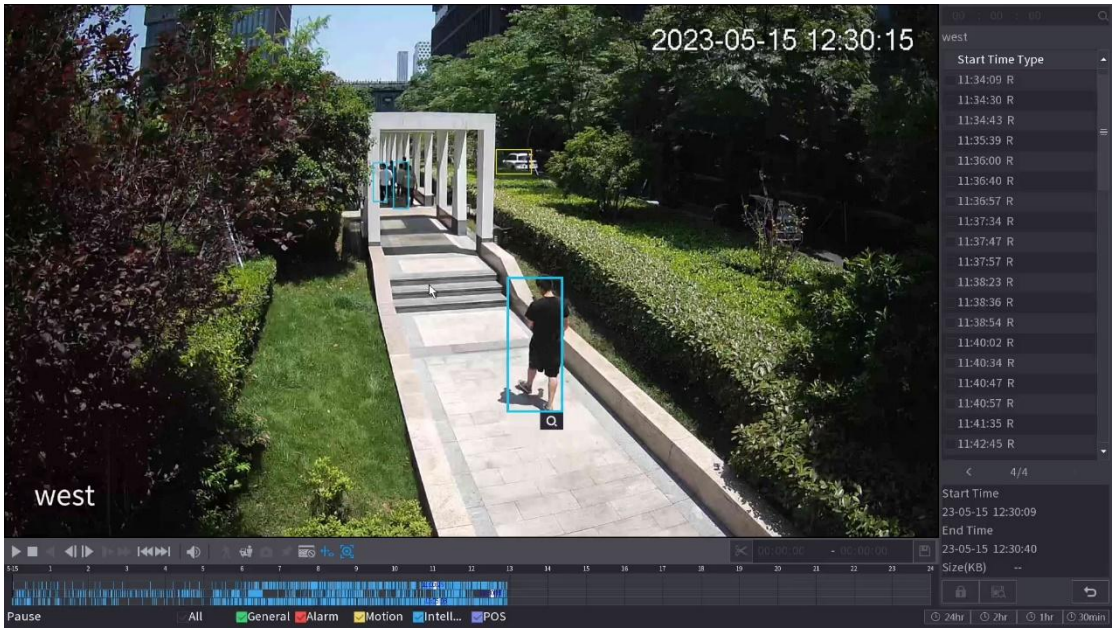


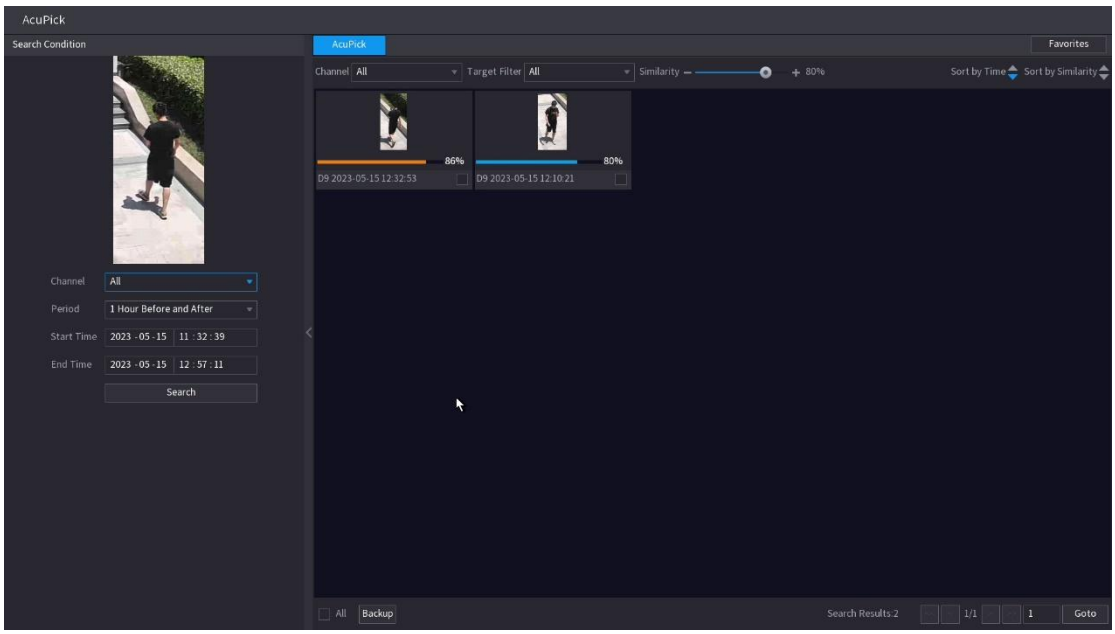
Method 2: Based on the intelligent search function of intelligent events, the video clips related to the events are traversed and viewed in turn by taking relevant intelligent events as a unit.



In summary, the efficiency of these two methods is too low.

With the help of Dahua AcuPick, search becomes easier with high efficiency and accuracy.





2.3 Applicable Scenes

For details, see WizMind S Series_AcuPick_Installation and Commissioning Manual.

3 Advantages of AcuPick Technology

Dahua AcuPick technology features high intelligence and fast search speed. Relying on a large amount of abundant training data and industry-leading deep learning algorithms, it supports accurate recognition and quick matching of people's shapes and

vehicles in various scenes.

In terms of people features, AcuPick can recognize the appearance information of people, such as body shape, clothes color, clothes texture, hair style, and shoes style. It does not rely on the unique identity authentication information of people such as face and other biometric information. AcuPick not only meets the needs of users in the search accuracy and efficiency, but also protects the privacy of personnel, making the application scenes and value space of Dahua products more extensive.

Dahua AcuPick technology has good compatibility and extensibility. It can extract different features of different objects, such as persons and vehicles. On this basis, the algorithm can continuously iterate and combine multiple features to provide more accurate video search services. In addition, the binary data representation of the object features is well designed and extended to adapt to the iterative updating of the algorithm in the future.

Dahua AcuPick technology has good functionality and interactivity. You can manually adjust the sensitivity (search threshold) to meet the search requirements under different standards.

4 Data Protection Compliance

Dahua AcuPick is designed to support the respect of the privacy of individuals and the protection of their personal data and the platform has been designed to follow the commonly shared data protection principles. It is worth noting that AcuPick deployment's compliance with existing legislations shall be assessed by the users on a per-case basis that vary from country to country.

Data Minimisation,

By design, the AcuPick complies with the data minimisation principle. It does not analyse facial biometrics nor use AI for this purpose. Therefore, as far as the commonly shared data protection legislation, e.g. GDPR is concerned, AcuPick does not automatically attribute a name to an individual, nor make him/her automatically identifiable. In other words, AcuPick can recognise that an individual with certain characteristics is probably present in a video, but it cannot and is not intended to identify him/her nor making a definitive match with individual's identity.

Data Protection by Design, Data Protection by Default

AcuPick supports data protection by design and data protection by default principles as it does not include the ability to enable features allowing to identify or make a natural person identifiable directly from the AcuPick platform. Natural person identification, it worth repeating, may happen by other means, provided that the users have legal access to them. Therefore, it must be stressed once again that when using AcuPick, GDPR compliance level must be assessed on a per-case basis.

Data Integrity and confidentiality

When an object meets the search criteria, the information is encrypted locally and then sent to the backend over a secure channel. Only when at destination, the information is decrypted and

furtherly processed. This modus operandi guarantees the data chain of custody from the source to the destination. Together with operational accountability (see next paragraph), these features protect the information from tampering and unauthorised access.

Accountability

AcuPick is designed to be used in a networked environment, accessible through user access rights management and log monitoring. The data controller has the ability to dynamically decide which users can access the feeds and run the recognition platform, while at the same time having a system log that allows the identification of the users who have accessed the platform. Therefore, we sincerely encourage every user to establish strict policies and standards to ensure that AcuPick technology is used in good faith.

5 AcuPick - Trustworthy AI

Dahua is committed to fulfilling the mission of "Making Society Smarter, Making Life Better", and actively embracing the three visions of Lawful, Ethical, and Robust proposed in the “Ethical Guidelines for Trustworthy AI”.

In order to effectively prevent and control AI technology ethics and AI security risks, we have established the organization of technology ethics, AI security compliance and compliance management to continuously carry out full life cycle management of AI research and development, applications, etc.

In addition, we guide all employees of the company to uphold the values of justice, fairness and sustainability in technological innovation activities, promote technological innovation to serve the improvement of social welfare, the protection of human dignity, privacy and fair opportunities, respect for diverse cultures, and compliance with social ethics and legal norms.

Dahua promises that we actively implement the seven principles of Trustworthy AI and provide customers with trustworthy products, services and solutions.

① Human Agency and Oversight：

We design AI systems to empower user autonomy, uphold fundamental rights, and promote a democratic and equitable society, ensuring all systems remain under human oversight to align with ethical standards and client expectations.

② Technical Robustness and Safety：

We ensure AI systems are reliable and safe through risk-preventive development, minimizing unintended harm, adapting to environmental changes, resisting interference, and safeguarding users’ physical and mental well-being.

③ Privacy and Data Governance：

We are committed to eliminating data biases, ensuring data integrity, and protecting privacy and data security.

④ Transparency：

We commit to traceable AI systems, providing clear and understandable explanations, and ensuring that the capabilities and limitations of the AI system are clearly communicated to you.

⑤ Diversity, Non-Discrimination, and Fairness：

We foster diversity and fairness throughout the AI lifecycle through inclusive design, ensuring equal access and equitable treatment while engaging all relevant stakeholders.

⑥ Societal and Environmental Well-Being：

We promote sustainability and ecological responsibility in AI systems, developing technology and solutions that support global goals, such as the Sustainable Development Goals, to benefit society and the environment.

⑦ Accountability：

We establish robust mechanisms to ensure accountability for AI systems throughout their development, deployment, and use, fostering trust and responsibility in all outcomes.

Based on our understanding of the EU AI Act, we believe that AcuPick Technology belongs to Minimal or No Risk AI. We will continuously comply with the requirements of relevant laws and regulations, and explore technical solutions and industry best practices based on the intended purpose and potential impact of AcuPick Technology. At the same time, we are also deeply concerned about the various issues that may arise from your deployment of AcuPick Technology, as well as the impact that Acupick may have on society and the environment. Your sharing and feedback will help us constantly improve AcuPick Technology.

We also sincerely remind and appeal you to comply with applicable laws and regulations when deploying and using Acupick Technology. Let us work together to practice the concept of technology for good, achieve a beautiful integration of technological innovation and social welfare, and jointly build a safe, inclusive and sustainable future.

6 Summary

Based on the deep-learning algorithms of target detection, tracking, and behavior analysis, Dahua AcuPick technology can quickly filter objects, and search for history information of interested targets by comparing the target features captured by IPC with features in the database. It is applicable for use in various scenes, such as villas, shops, warehouses, restricted areas, fish ponds, and orchards. Dahua AcuPick technology is not only powerful but also easy to use, which truly realizes the integration of AI into life and brings benefits to people.