A Technology Together with a Dream

Machine Vision in China

There was a legend in the ancient orient that someone might obtain the insight by hard anneal and self-cultivation, and the Bible also described that our human ancestors had suffered the original sin in order to understand the world. So it is obvious that people must undergo crucifixions before they may understand the real world, and this is similar true both in east and west cultures. However, only in our modern industrial society, the technology machine vision may bring a great extension and liberation to the function of human perception.

Quelle:Flickr/NormaDesmond

The Status of Machine Vision in China

In China, the application of machine vision came with the introduction of technology in the 1980s; and it was firstly used in semiconductor and electronics industry. The application of machine vision in this industry has played a pivotal role in improving the quality and productivity of electronic product manufacturing. At present, China is becoming one of the most active regions for machine vision growth in the world, and the scope of applications has covered almost all sectors of national economy, including industry, agriculture, medicine, military, aerospace, meteorology, astronomy, public security, transport, scientific research and others. However, the application in industry accounts for the largest share, and the important reason may be that China has become the machining center of the global manufacturing industry.

Reviewing the existing achievements will help us to understand the present situation and future needs of machine vision in China. Machine vision technology has been successfully applied in almost all industrial test fields. At the same time, China is a large agricultural country with rich agricultural products, thus it is of great significance to automatically clas-

sify the agricultural products automatically and practice right quality for right price so as to produce better economic results. With the rapid development of industrialized agriculture, the machine vision technology is also an important application in monitoring the crop growing status to enable the scientific irrigation and fertilization.

The requirements determine the products. Machine vision has mastered the initiation and development phases in China. The next step is how to tend towards the future in China's social environment.

Trends in Manufacturing Industry

There are many factors affecting the launch, application and growth of machine vision, which not only include technical aspects but also the commercial part. At present, the needs from manufacturing are crucial. The development of the manufacturing industry promotes the needs of machine vision, and it also determines that machine vision will gradually develop from simply collecting, analyzing, delivering data and judging action to systematization, "intelligentization" and Specialization. This trend at the same time indicates that machine vision

technology and automatic equipment will be more closely integrated.

Except for the semiconductor and electronics industries as the main growth areas for machine vision, it should be fully noticed that the Chinese government may continuously increase its efforts to upgrade the traditional manufacturing industry. They have put forward the scientific development thoughts of "the information technology drive industrialization", and track "the new industrialization road" in recent years. This brings unprecedented opportunities for the development of machine vision. In the next few years, with the developing of China´s manufacturing industry, the application status of machine vision will change from the low-end in the early stage to the high-end, and the manufacturing automation will be developed toward the smart, efficient, high-quality and precise direction.

Roadmap to Promote the Development of the Chinese Machine Vision Market

The goals for the further development of machine vision products have gradually formed as follows:
1. To form a unified and open standard. Machine vision products and the re-

lated technologies can be developed and matched in a common platform to promote the application of Chinese machine vision to meet the international standards, and also to boost the whole industry development.

2. As for the products, machine vision will decreasingly depend on the PC technology, and it will be more closely integrated with the control and measurement of other data collection means. The embedded visual products will gradually replace the PC card-based products and SDK methods, so as to enhance the reliability and maintainability of the vision products and to facilitate continuous improvement and upgrading.

3. The vast standardization technology is required to be adopted in the machine vision products, the secondary development may be carried out according to the user requirements so as to adapt the manifold needs. At the same time, machine vision equipment manufacturers are not only the providers, but have the system integration capability to solve problems.

The development of modern vision theory and technology requires that machine vision products can not only be able to simulate the functions of human eyes, more importantly it shall be able to finish the jobs that human eyes are insufficient for. Based on the continuously maturing and perfection of today's technologies of electronics, optics and computer, many advantages of machine vision, such as automation, objectivity, non-contact and high-precision, high-speed as well as the reliability of industrial on-site environments, have been very apparent.

Market Survey

The survey result, which is carried out by "Control Engineering China", about the current application of machine vision products in China and the user's specific requirements may be helpful to the fu-

ture market development strategy. According to the statistics, the application fields which mostly use machine vision today are ranked as motion control, testing, diagnosis, testing and maintenance, SCADA, continuous processing and batch processing, machine control, CNC, robots and so on (see fig. 1).

Figure 2 shows the major application obstacles of machine vision products in the Chinese market. The listed six factors are budget limitation, the uneasy usage, the project implementation resource limitation, the acceptance level by operators, the understanding on the visual technology, the priority level being not high enough compared with other automation projects. It also indicates that the most prominent obstacles in the current application may be the insufficient understanding of vision technology and budget constraints.

Figure 3 shows the investigation results regarding user criteria for selecting machine vision products. The most important criteria are the technical support ability and the complete solution (including software) delivery ability of the supplier. The price factor is only ranked as number 6.

The Rising Domain of Machine Vision Demand in China

China is at a high-speed stage of economic and social development, along with a rapid urbanization process and the implementation of a large number of infrastructure projects, all required to install "electronic eyes", and these applications have put forward the urgent needs for high-end vision products with intelligent image processing and analysis functions.

In order to strengthen the social security, visual monitoring has become a basic city security measure. For example, Guangdong will install 1 million surveillance cameras to cover all key areas till 2010. Moreover, 250,000 "surveillance cameras" have been used only in Guangzhou for monitoring the city zone

at present. Similar to European countries, a lot of cities in China will enter the information security era with millions of "electronic eyes".

One of the most important goals for intelligent visual monitoring systems is to reduce the rate of false alarm. The errors are mainly due to moving objects in the monitoring area, such as a shadow of a flying cloud, reflected light of the sunshine, and also are possible from the system themselves, camera shaking with wind, light and aperture mismatched, and so on. Especially in the field of bank applications, it is required to see the people and scene features by adopting the natural contrast correction under a strong light contrast, and it has become the key factor for success or failure of the whole monitoring system. In addition, the application fields such as the detection and identification of fingerprints, pupils, facial features have become an area for rapid growth of machine vision.

The Ecological Analysis of the Machine Vision Market

In the current and also the coming period, the machine vision market in China will mainly indicate the ecological characteristics which are interdependent and promote each other between technology, price and applicability.

The two main points are technical factors. Firstly, it is more difficult to design and implement high-end systems due to the composition of the machine vision application which may involve various specialties. Secondly, the miniaturized and integrated products will become an important direction to achieve "the vision system on chip", the development of the intelligent machine vision and the automatic image information analysis system have indicated the significant advantage of the integrated visual products.

As for the machine vision product prices, the cost performance is an important factor in the current market. Even as one thought by industry experts, the own unique industry individuality of machine vision is the universality of product applications; the other is that its products can not directly create value. The high expectations from users in machine vision technology and the high development costs of the vision device hardware and software research will be the contradiction between supply and demand in the market development in the future time. To resolve this problem, we mainly rely on technical progress and improvement of the product cost performance.

As for the applicability, it appears in the integration of technologies and de-
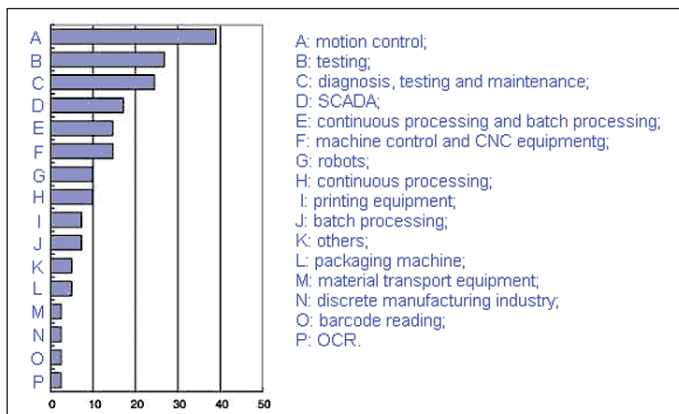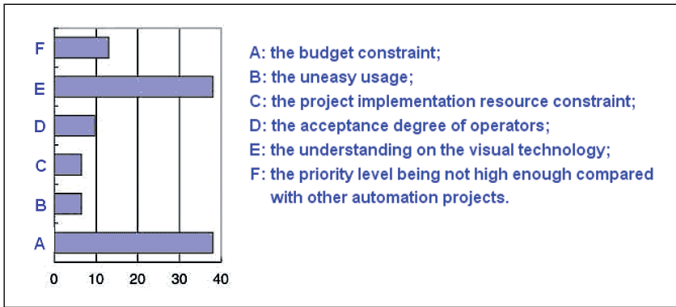

A: motion control;
B: testing;
C: diagnosis, testing and maintenance;
D: SCADA;
E: continuous processing and batch processing;
F: machine control and CNC equipmentg;
G: robots;
H: continuous processing;
I: printing equipment;
J: batch processing;
K: others;
L: packaging machine;
M: material transport equipment;
N: discrete manufacturing industry;
O: barcode reading;
P: OCR.

Fig. 1: Machine Vision Applications

Fig. 2: Major obstacles for the application of machine vision products

A: the budget constraint;
B: the uneasy usage;
C: the project implementation resource constraint;
D: the acceptance degree of operators;
E: the understanding on the visual technology;
F: the priority level being not high enough compared with other automation projects.
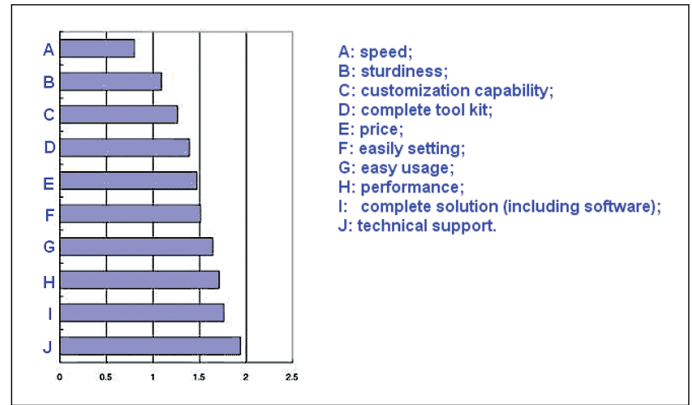
Fig. 3: Decision criteria for users to select machine vision products

A: speed;
B: sturdiness;
C: customization capability;
D: complete tool kit;
E: price;
F: easily setting;
G: easy usage;
H: performance;
I: complete solution (including software);
J: technical support.

mands. As mentioned above, the diversified and personalized programs of machine vision products and systems, and the professional services may be increasingly important. At the same time, during the developing process of product miniaturization technology, it should be able to gradually overcome the weakness of too "complicated" operating conditions, so as to realize its application in the limited space and conditions provided by users.

What requires special attention is that the relation between machine vision technology, which is interdisciplinary and cross-industry, and the integrative mechanical system covering the light mechanical/electrical and software, is very close. However, the severe shortage of the required talents, the insufficiency of application engineers and their knowledge structure may affect the research and development of machine vision products and the industrialized application capacity. Even as the rising and development of the computer technology has directly corresponded with the increasing pullulation of computer professionals in

software and hardware. CMES, the China Mechanical Engineering Institute, who leads China's manufacturing industry and its subordinate industry committees, will play the important role in organization, popularization, policy support for technical guidance, personnel training, project planning, foreign cooperation and market development.

Conclusions

During the 20 years of development, the machine vision technology is not only one interdisciplinary and cross-industry field with the character with high and new technologies integration. Moreover, it also is becoming one emerging industry with the goal of intelligent information systems and mechanical intelligence. It becomes a new technology and economy development point which has caught the attention of all sectors of the community. In its application areas, effects such as the automation, informationization, intellectualization, high-quality, high efficiency, high precision have been

achieved. With the continuous application of new technologies and theories in machine vision systems, the peoples sensing capability may encompass the span from "Giant" to "Remoteness" so that people come to a fully new cognitive world and complete the tasks which may be difficult or impossible to carry out today. Therefore, machine vision will boost the development of productivity and the great progress of society.

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