Machine Vision AI in Industry 4.0 Technical Talk Report

By Prof. Dr. Yeap Gik Hong

Electronic Engineering Technical Division Committee Member

Machine vision is key technology for these interconnected production processes. No other component is able today to gather and interpret as many data as machine Vision. The idea is to verify and process what has been "seen" and transmit the results to the systems of the value chain in every phase of Production. This is not only about finding out whether a part is good or insufficient but about triggering intelligent actions. Many machine vision systems nowadays are already more than just mere inspection systems today. They enable early identification of trends in production processes with appropriate interpretation and processing of results and therefore are consistent with the philosophy of Industry 4.0. For example, the increasing wear of a tool can be seen from increasing numbers of errors or the progressive deterioration of the quality characteristics of finished products-Preventive maintenance.

This technical talk delves into the applications of machine vision in different industry, introduction to Industry 4.0, Big Data, Internet of Things (IOT) and Machine Learning. It was held on 15th March 2024 from 6.30 – 8.30 pm physically at IEM Penang Branch. The speaker of this technical talk was Ir. Dr Kenny Ang, the Director of Control Easy Technology Sdn Bhd. Control Easy is a local company specialized in Machine Vision & Control Automation. They have successfully completed many projects of either government sector or private sector. They participate actively in different type of automation projects, and provide best solutions to their clients, according to the clients' needs. There were 12 participants attended the technical talk.

Ir. Dr Kenny started the talk by showing some videos of the machine vision applications developed by his company that being showcased at different exhibitions such as 2023 MetalTech/AutoMEX Exhibition, 2019 Smart Manufacturing Exhibition (SMEX), etc. He then briefly introduced the company. The services provided by the company includes but not limited to system proposal and Mechanical conceptual design, mechanical fabrication and assembly, detailed loop diagram, panel drawing, electrical schematic, terminals and etc, fabrication of machines, panels, wiring and mimic diagram, software for Machine Vision, Motion, PLC, PC Based Control, SCADA / Telemetry System, field installation, calibration, site testing & commissioning, as well as training on operation and maintenance services.
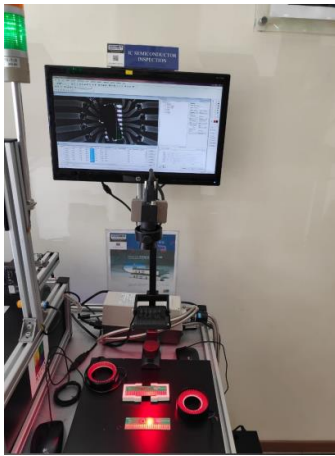
He explained the benefits of machine vision in Industry 4.0 include optimized and direct networking of machine vision with the production systems, improve factory efficiency, reduce waste, refine product quality, decrease operating cost and down-time, produce more complex but in less time (flexible production control), etc. He then showed the application of machine vision in different industry as shown in Figure 1 below.

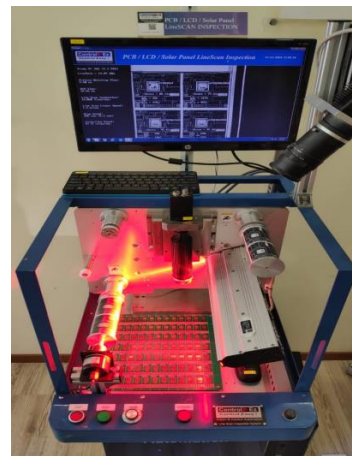| (a) Industry 4.0 Station – AI & IOT | (b) F & B Bottling Inspection |

| (c) IC Inspection | (d) Medical Inspection | (e) PCB Linescan Inspection |

Figure 1. Application of Machine Vision in Different Industry

After that, Ir. Dr Kenny explained about Industry 4.0, Big data, Internet of Things (IOT), and Deep Learning. IOT linking all factory objects into network based on internet technologies. Everything driven by internet technology (everything connects to everything), people, machines, production resources and products will directly communicate with each other and be interconnected online, access data – new form of production – workflow integrated - Smart Automation as shown in Figure 2 below. The "Smart Factory" resulting from this will follow a completely new production from static to dynamic (IR 3.0 to IR 4.0)– more communication objects – RFID – access data through cloud – extend system dynamically – APP bring new functions as shown in Figure 3.
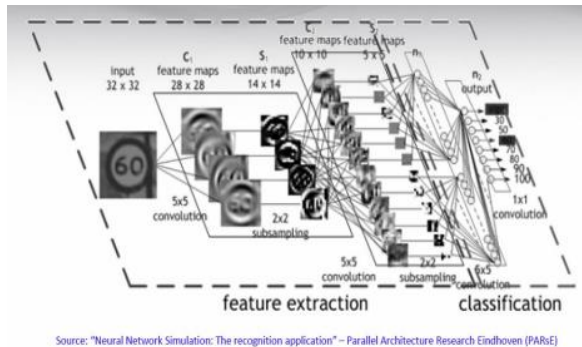
He continued by explaining the neural network simulation, the significance of deep learning for machine vision and training of the Convolutional neural network (CNN) model as shown in Figure 4. AI Technology will definitely bring a big revolution in our industry. For coming future, we may not need to write any programming code especially when come to the objects / products identification or classification solutions. Machine vision can help, especially the so–called sample-based identification (SBI) / DL. The product information is obtained from trained comparison images, and objects are unambiguously identified and classified with the help of features such as texture or colour. Unpackaged vegetables can thus be identified at the cash register without problems – and without using any bar or data codes.

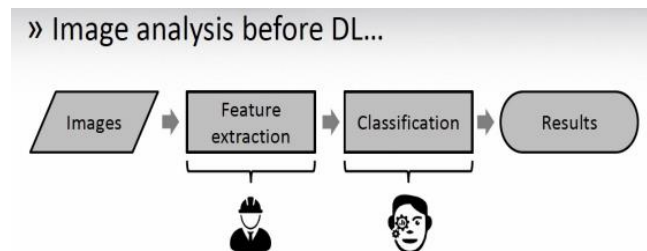*Figure 2. Internet of Things (IOT) and Industry 4.0*

Figure 3. Smart Industry/Factory

Figure 4. Deep Learning for Images

Ir. Dr. Kenny concludes that Industry 4.0 emerge innovations in advanced automation, machine vision, Big Data, internet, cloud computing and deep learning (DL) will revolutionize manufacturing.

Prof. Dr. Yeap Gik Hong introducing the speaker, Ir. Dr. Kenny Ang and the certificate presenting ceremony.