1. Development of vision-based 3D measurement technologies in factory automation has been rapidly progressing with the performance advances of camera or projector from the viewpoint of high speed image acquisition, high resolution and price reduction. Main applications in factory automation are, for example, shape reconstruction or distance measurement as a role of a visual sensor of robot or inspection machine. In this paper, recent trends of vision-based 3D measurement technologies are introduced so far as space permit.

2. Triangulation is a common method for restoration of 3D scenes. However, the frame rate achievable with triangulation tends to be less than 30 fps due to its time-consuming stereo matching process, and this is an obstacle if the application requires real-time feedback of the results. To solve this problem, a new method called Structured Light Field (SLF) method was proposed. It estimates depth information by projecting information about the distance to a target directly. In this presentation, the basic concept and experimental results are described.

3. With conventional lighting, irradiating light uniformly over all points on the surface of an object that extends two-dimensionally is very difficult by any means other than using parallel light. With parallel light, there is no other degree of freedom; therefore, the only option is to use various shapes of light to seek lighting conditions that can compromise. VISA-Method Lighting enables uniform and constant lighting at all points on the surface of an object and as well as uniform lighting at each point within a certain solid angle range. Furthermore, it allows the shape of the irradiation light to be freely adjusted.

4. Individual identification or serialization of parts and products is essential for the individual-level traceability throughout all the production process. It enables us to track/trace all the individuals manufactured in the factory lines, then we can collect big data of processing (input) and quality (output) of each process, and furthermore, their correlations over the multiple process. To this end, serial marking or ID tags are generally attached onto each part/product, however there are numerous parts and products that cannot accept such marking or tagging due to costs, small size or surface physics. In this lecture, we introduce our tag/marketing-less ID method using “Fingerprint of Things”. It can identify each individual of the same parts by matching images of micro features on the surface.
5. マシンビジョンカメラ用レンズの光学設計技術
岡田 和佳（富士フイルム㈱）
In recent manufacturing scenes, an image of a target object is taken by a machine vision system, and the target object is automatically positioned, measured, or checked. To increase the production efficiency or for the strict quality control, the machine vision system needs to improve the image recognition accuracy and the processing speed. Thus it is necessary that a machine vision lens is high-resolution from the center to the edge. FUJIFILM has been developed the machine vision lenses to satisfy these needs. In this paper, we introduce a "4D High Resolution" which achieves two-dimensional resolution flatness and suppressions of resolution decrease caused by a working-distance variation and a Diaphragm variation. And we explain the optical design technique which is essential to realize "4D High Resolution".

6. カラー画像と近赤外線画像を同時に撮影可能なイメージングシステム
奥富 正敏（東京工業大学）
近年、コンピュータビジョンおよび画像処理の分野において、カラー画像と近赤外線画像を同時に利 用した応用が数多く提案されている。これらの応用では一般に、位置ずれのないカラー画像と近赤外線画像のペアを入力とする。しかしながら、この画像ペアを撮影するには、一般に複数台のカメラや 複数回の撮影が必要となり、イメージングシステムのコストやサイズ面で課題が残る。一方で筆者ら は、これまでに単板撮像素子により位置ずれのないカラー画像と近赤外線画像を同時に撮影可能なイ メージングシステムを開発してきた。本稿では、筆者らが開発したイメージングシステムについて概 説し、その応用例を紹介する。

7. Deep Learning による物体認識と最新動向
藤吉 弘亘（中部大学）
Deep learning is a novel approach that can automate the process of extracting feature effective from images for visual recognition. Visual recognition by convolutional neural networks has overwhelming results in the general object recognition contest, and in various fields. In this paper, we will explain how deep learning is applied and how it is solved in the visual recognition tasks, and the latest trend of deep learning.

8. Deep Learning を用いた外観検査
久保田 進也（㈱シーイーシー）
High quality boasting of Japan's manufacturing is supported by the inspection process carried out in each process. Automation is being pursued in pursuit of stable inspection accuracy and cost reduction in the inspection process, but there are various problems with the conventional image inspection apparatus, and still many visual inspections remain. Software for visual inspection WiseImaging is trying to solve the conventional problem by using Deep Learning.