

# From Lectures

## Lecture 1

### Expectation for 8K Super Hi-Vision to Be Introduced in the Medical Field

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Development of 8K Super Hi-Vision is under way in earnest. Clearer pictures can lead to new discoveries and change people's awareness and behavioral patterns. Humans have developed telescopes and microscopes so that they can see things more vividly. But those instruments only serve the needs of individual observers. For many people to share the same experiences, high-resolution images are indispensable.

High-resolution images have a broad range of applications in medical practice. They can be immediately applied to telemedicine and medical education. As Japan suffers from shortage of clinical pathologists, a limited number of experts are available for diagnosing specific cancers across the country. A combination of information network and high-resolution images would be of great help to medical services not only in remote areas but also in urban communities.

High-resolution images are highly useful in learning surgical techniques. In recent years, an increasing number of operations entail repairing tiny blood vessels or nerve fibers. Using magnifiers or microscopes for that purpose has become common practice in operating rooms. These devices allow surgeons to clearly view the surgical areas, but assistant members in the room have to depend on TV monitors to understand how the operation is going and learn the surgeons' techniques. Improving the images' resolution will have huge educational effects on those novice surgeons, allowing them to watch very fine surgical threads and needle tops that can't be spotted on current high-definition TV monitors. Surgeons themselves will discover many things they don't notice during the operation by watching their performances on video screens afterward. In addition, pictures of magnified surgical areas will help identify the lesion locations.

Endoscopic examination has also advanced considerably. Endoscopes currently used to examine the stomach or intestines allow physicians to discern capillaries thanks to their enhanced resolution. If observation at a cellular level is made possible, doctors can detect cancers at an earlier stage. But many technical issues need to be cleared before endoscopes can provide sharper images to be displayed on an 8K Super Hi-Vision monitor. Japan is on the leading edge of developing endoscopic technology. In order to raise standards and encourage innovation in medical services, 8K Super Hi-Vision should be designed to work in conjunction with endoscopes as soon as possible.

## Lecture 2

### Seeing Both the Forest and the Trees: Techniques for Analyzing Big Data

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The advent of big data has ushered in a new era. The whole range of our life – every activity, movement and event that is taking place – can be digitized and recreated in the cloud now. Big data can create value for businesses in two main ways; it makes every business function and service smarter, and it helps discover innovations and thereby promotes effective investment toward the future. Similarly, big data can benefit the public sector by improving each service recipient's satisfaction on the one hand, and by helping discover rare, yet important, social factors on the other. Many technical challenges we face in using big data come from the demand that we achieve both of these contrasting goals. For example, no matter how huge the amounts of data might be, sampling would allow us to capture the general picture with some degree of accuracy. Yet, this common statistical procedure would most likely lead us to miss rare phenomena. This means that in order to make use of big data, we need techniques that let us see both the forest and the trees.

Big data techniques and technologies can be divided roughly into three elements. They are visualization, techniques for analyzing big data, and big data technologies. Visualization can be categorized as a technique of exploratory data analysis, but with the advent of big data, it has come to play a crucial role in Nowcasting (capturing the present). Big data technologies hold the key to resolving problems resulting from increases in data amounts and communications traffic. Advanced techniques for data analysis are essential when we deal with data incompleteness, which is a state where data cannot give complete information we aim to get. There are many, diverse examples of data incompleteness. Among them are such common problems as missing data and the presence of outliers. Some others, including unstable problem of inverse analysis, are inevitable results of the way inferences are made. In this lecture, I would like to describe issues that frequently emerge in big data analysis, and introduced current trends in studies on data analysis, including imputation, linkage, and stream computing.