


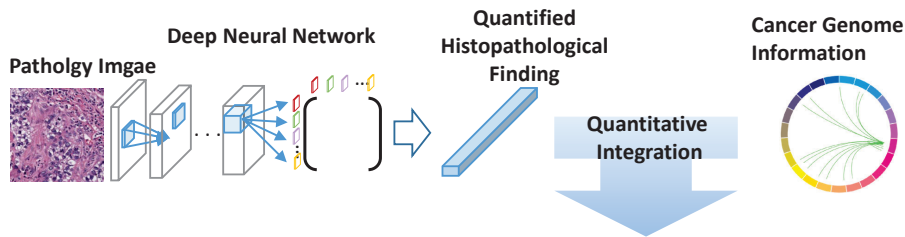
A New Definition of Gastric Cancer Diversity through Quantitative Integration of histological and Genomic Information

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Project Information	Project Number : 22H04990	Project Period (FY) : 2022-2026	
	Keywords : Cancer, Genome, Histopathology, Artificial Intelligence		

Purpose and Background of the Research

● Outline of the Research

Cancer classification is necessary for the proper diagnosis and treatment of cancer, but the current classification of cancer is divided into two categories: the conventional histopathological one based on appearance, and the classification based on new genomic information. The inability to quantitatively integrate these old and new classifications prevents the effective identification and classification of cancer diversity. In this research using stomach cancer, which is common in Japan, as a representative example, artificial intelligence technology is used to quantify histopathological images that have been difficult so far, and by quantitatively integrating genomic information and pathological tissue information in a large number of cases, we will grasp the overall picture of diversity and define new subclasses.



- A new definition of gastric cancer diversity by quantitatively integrating genomic and histopathological information
- Identifying clinically important novel subtypes and making implications for diagnosis and treatment
- Expanding effect on other cancer types using stomach cancer as a model case

Figure 1. Image of the Whole Project

● What is the classification of cancer?

The classification of cancer published by the WHO has become the world standard. Apart from organ-specific classifications such as lung, stomach, and colorectal cancers, there are currently more than 1,000 types of cancers that are classified according to the morphological characteristics of cancer cells, such as adenocarcinoma, squamous cell carcinoma, and small cell carcinoma. Basically, histopathological images are classified by a specialist doctor looking at them under a microscope, and this is called pathological diagnosis.

On the other hand, in recent years, by sequencing the genome of cancer cell (cancer genome), cancers have been classified based on genomic DNA mutations, such as "cancers that have mutant EGFR and KRAS genes".

● Quantification of histopathological images by artificial intelligence

In recent years, artificial intelligence technology has made it possible to extract abstract data that are difficult to quantify such as images as quantitative numerical values called "feature".

We have successfully quantified the cancer histopathology using deep texture information extracted from neural networks. Through such quantification, it is possible to quantify the abstract histopathological image information that has been judged by specialized physicians so far, and to integrate it with other clinical information such as cancer genome.

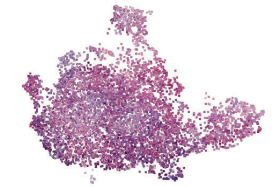


Fig. 2 The distribution of the diversity of histopathological images of approximately 7,200 cases of 32 cancer types, quantified by artificial intelligence, was expressed by two-dimensional mapping. One small □ represents a histopathological image of single case.

Cell Reports 38(9):110424. 2022

Expected Research Achievements

● Integration of cancer genome information and pathological tissue information in gastric cancer

Stomach cancer is the second most common cancer incidence and third highest cancer deaths among Japan people. Like other cancer types, the outline of its diversity has become clear through cancer genome sequencing. Gastric cancer is extremely diverse, and the site of development, carcinogenic mechanism, cell series differentiation, interaction with driver genes, stroma, cancer immune status, etc. vary greatly from case to case and are reflected as complex clinical characteristics.

In this research, we grasp the overall picture of diversity and define new subtypes by accumulating large-scale genomic as well as histopathological information of gastric cancer, through quantifying histopathological using artificial intelligence technology.

We will develop artificial intelligence technology to grasp the biological meaning of cancer pathological histology, and extract the significant cancer-stromal interactions.

● Progress and impact that leads to social life

By comparing the potential subclasses identified in the study with clinical information, we will clarify their identity from the viewpoint of diagnosis and treatment, and try to discover new preventive and therapeutic intervention targets.

Although this study is mainly aimed at stomach cancer, the concepts obtained here will be widely applicable to other cancer types in the future.

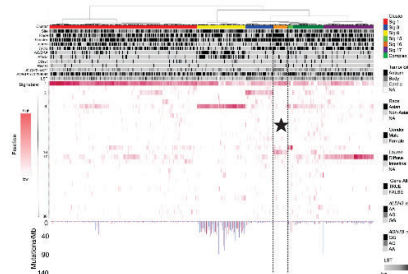


Fig. 3 Diversity of gastric cancer by cancer genome Classification by pattern of mutations of about 500 gastric cancer genomes of various ethnic background. It shows that there are so many potential subtypes within stomach cancer category. ★ The mark is so-called "drinking&smoking-related stomach cancer" characteristic in East Asians.

Science Advances 6(19):eaav9778. 2020