[Document name] Claims

[Claim 1]

A pathological diagnosis assisting method including:

an image acquisition step of continuously acquiring microscopical observation image data of a tissue specimen;

a step of dividing the image data into a predetermined size while maintaining positional information and obtaining an image patch;

a decision step of determining a histological type for each image patch, on the basis of training data obtained by machine learning; and

a reconstructing step of displaying the determined histological type at each position.

[Claim 2]

The pathological diagnosis assisting method according to claim 1,

wherein the reconstructing step of displaying the histological type determined by machine learning at each position displays a change in the degree of differentiation in the tumor and heterogeneity of the tumor.

[Claim 3]

The pathological diagnosis assisting method according to claim 1 or 2,

wherein the machine learning is based on a neural network.

[Claim 4]

The pathological diagnosis assisting method according to claim 3,

wherein the neural network uses images having resolutions of 0.1 μm/pixel to 4 μm/pixel, as images for training.

[Claim 5]

The pathological diagnosis assisting method according to any one of claims 1 to 4,

wherein the tissue specimen is derived from a cancer tissue and pathological diagnosis of cancer is assisted.

[Claim 6」

The pathological diagnosis assisting method according to any one of claims 1 to 5,

wherein the tissue specimen is an HE-stained specimen or an immunohistochemically stained specimen.

[Claim 7]

The pathological diagnosis assisting method according to claim 6,

wherein when the HE-stained specimen is a non-standardized specimen, a neural style transfer method is used, a quasi-immunohistochemically stained specimen is prepared, and

the histological type is determined by a learning model which has learned an immunohistochemical stained specimen image.

[Claim 8]

A pathological diagnosis assisting system including:

image acquisition means for continuously acquiring microscopical observation image data of a tissue specimen;

image processing means for dividing the image data into image patches having predetermined sizes while maintaining positional information;

classification means for determining a histological type for each divided image on the basis of training data obtained by machine learning; and

reconstructing means for displaying the classified histological type at each position.

[Claim 9]

The pathological diagnosis assisting system according to claim 8,

wherein the image processing means includes means for standardizing a tissue stained specimen.

[Claim 10]

The pathological diagnosis assisting system according to claim 8 or 9,

wherein the machine learning is a neural network.

[Claim 11]

The pathological diagnosis assisting system according to claim 10,

wherein the neural network uses a parameter value of a histological type, which has been obtained in advance by transfer learning.

[Claim 12]

The pathological diagnosis assisting system according to any one of claims 8 to 11,

wherein a disease assisted by the pathological diagnosis assisting system is cancer.

[Claim 13]

A pathological diagnosis assisting program causing a computer to execute processes of:

dividing acquired image data into a predetermined size while maintaining positional information;

using a learning model learned by use of training data;

determining a histological type for each divided image by machine learning; and

displaying the determined histological type at each position to reconstitute the histological types.

[Claim 14]

The pathological diagnosis assisting program according to claim 13,

including a process of continuously acquiring microscopical observation images of a tissue specimen.

[Claim 15]

A pre-trained model for determining a histological type of image data on the basis of microscopical observation image data of a tissue specimen, including:

an input layer for which microscopical observation image data of a tissue specimen of interest is divided into a predetermined size, and to which the divided data is input;

an output layer for displaying a histological type decision result of the divided image data at each position of the tissue specimen, the pre-trained model being for causing a computer to function,

wherein the computer includes a classifier for classifying a histological type based on data learned on the basis of the histological type image of which has been decided by a doctor, as training data, and

determines a histological type of microscopical observation image data that has been input and divided into a predetermined size, and displays the histological type at each position of a tissue specimen.

[Claim 16]

The pre-trained model according to claim 15,

wherein the training data is obtained by preprocessing images.

Claims

[Claim 1]

A pathological diagnosis assisting method comprising:

an image acquisition step of continuously acquiring microscopical observation image data of a tissue specimen;

a step of dividing the image data into a predetermined size while retaining positional information on a whole specimen and positional information on a tissue image, and obtaining image patches;

a determination step of determining a class for each image patch, according to a feature extracted by machine learning from data for training; and

a reconstructing step of displaying determined classes at each position of the tissue images, and reconstructing the classes in the whole specimen.

[Claim 2]

The pathological diagnosis assisting method according to claim 1, wherein

the reconstructing step of displaying the classes determined by the machine learning at each position and reconstructing the classes in the whole specimen causes heterogeneity of a tumor to be displayed.

[Claim 3]

The pathological diagnosis assisting method according to claim 1 or 2, wherein

the machine learning is based on a neural network.

[Claim 4]

The pathological diagnosis assisting method according to claim 3, wherein

the neural network uses images having resolutions of 0.1 μm/pixel to 4 μm/pixel, as images for learning.

[Claim 5]

The pathological diagnosis assisting method according to any one of claims 1 to 4, wherein

the tissue specimen is derived from a cancer tissue, and

pathological diagnosis of cancer is assisted.

[Claim 6]

The pathological diagnosis assisting method according to any one of claims 1 to 5, wherein the tissue specimen is an HE-stained or immunohistochemically stained specimen.

[Claim 7]

The pathological diagnosis assisting method according to claim 6, wherein

when the HE-stained specimen is a non-standardized specimen,

a neural style transfer method is used,

a quasi-immunohistochemically stained specimen is prepared, and

the class is determined by a learned model that has learned an immunohistochemical stained specimen image.

[Claim 8]

A pathological diagnosis assisting system comprising:

image acquisition means for continuously acquiring microscopical observation image data of a tissue specimen;

image processing means for dividing the image data into image patches having predetermined sizes while retaining positional information on a whole specimen and positional information on a tissue image;

classification means for determining a class for each divided image patch, according to a feature extracted by machine learning from data for training; and

reconstructing means for displaying the classified class at each position, and reconstructing the classes in the whole specimen.

[Claim 9]

The pathological diagnosis assisting system according to claim 8, wherein

the image processing means comprises means for standardizing a histologically stained specimen.

[Claim 10]
The pathological diagnosis assisting system according to claim 8 or 9, wherein
the machine learning is a neural network.
[Claim 11]
The pathological diagnosis assisting system according to claim 10, wherein
the neural network uses a parameter value that has been obtained in advance by transfer learning.
[Claim 12]
The pathological diagnosis assisting system according to any one of claims 8 to 11, wherein
a disease pathological diagnosis of which is assisted is cancer.
[Claim 13]
A pathological diagnosis assisting program causing a computer to execute processes of:
dividing acquired image data into a predetermined size while retaining positional information on a whole specimen and positional information on a tissue image;
using a trained model that has trained by use of data for training;
determining a class for each divided image patch, according to a feature extracted by machine learning from the data for training; and
displaying the determined class at each position of the tissue image, and reconstructing the classes in the whole specimen.
[Claim 14]
The pathological diagnosis assisting program according to claim 13, comprising a process of continuously acquiring microscopical observation images of the tissue specimen.
[Claim 15]
A pre-trained model for determining a class of image data on the basis of microscopical observation image data of a tissue specimen, comprising:

an input layer for which microscopical observation image data of a tissue specimen of interest is divided into a predetermined size, and to which divided data is input; and

an output layer for displaying a class determination result of the divided image data at each position of the tissue specimen, the pre-trained model being for causing a computer to function, wherein the computer

comprises a classifier for classifying the classes according to a feature extracted by machine learning from data for training, and

determines a class of microscopical observation image data that has been input and divided into a predetermined size, displays the class at each position of a tissue specimen, and reconstructs the classes in the whole specimen.

[Claim 16]

The pre-trained model according to claim 15, wherein the data for training is data with which images have been preprocessed.