## [CLAIMS】

[Claim 1]

A multi-cancer simultaneous diagnosis system which is based on artificial intelligence and uses exosome SERS signals, the multi-cancer simultaneous diagnosis system comprising:

a signal acquisition unit configured to drop exosomes acquired from a measurement target person on a chip to acquire a plurality of the exosome surface enhanced Raman spectroscopy (SERS) signals from the chip;

a cancer diagnosis unit configured to acquire signal values of 0 or 1 for each of the plurality of exosome SERS signals by inputting the plurality of acquired exosome SERS signals to a trained cancer classification algorithm and configured to diagnose cancer or normality by using an average of the acquired signal values; and

a cancer information providing unit configured to acquire the signal values of 0 or 1 for each of the plurality of exosome SERS signals by inputting the plurality of exosome SERS signals to a plurality of tissue of origin (TOO) determination algorithms when diagnosed as the cancer, configured to predict a cancer type by using the average of the acquired signal values, and configured to provide information on the predicted cancer type,

wherein the cancer classification algorithm is trained, by using a plurality of first exosome SERS signals obtained from exosomes collected from plasma of a normal person and labeled as 0 and a plurality of second exosome SERS signals obtained from exosomes collected from plasma of cancer patients having a plurality of cancer types and labeled as 1, to classify each of the plurality of first exosome SERS signals and the plurality of second exosome SERS signals as 0 or 1, and

wherein the plurality of TOO determination algorithms respectively correspond to the plurality of cancer types, and each of the plurality of TOO determination algorithms is trained, by using the second exosome SERS signal acquired from a cancer patient having a preset cancer type among the plurality of cancer types and the second exosome SERS signals acquired from other cancer patients excluding the cancer patient having the preset cancer type, to determine whether an input exosome SERS signal corresponds to the preset cancer type.

[Claim 2]

The multi-cancer simultaneous diagnosis system of claim 1, wherein

the signal acquisition unit acquires an exosome SERS signal map including n*m exosome SERS signals from the chip including n*m (where n and m are identical or different natural numbers) dot arrays.

[Claim 3]

The multi-cancer simultaneous diagnosis system of claim 2, wherein

the cancer diagnosis unit inputs the n*m exosome SERS signals to the cancer classification algorithm and outputs signal values of 0 or 1 respectively corresponding to the n*m exosome SERS signals, and classifies as normality when an average of the output signal values is close to 0 and classifies as cancer when the average of the output signal values is close to 1.

[Claim 4]

The multi-cancer simultaneous diagnosis system of claim 3, wherein

the cancer information providing unit inputs the n*m exosome SERS signals to the plurality of TOO determination algorithms, and the plurality of TOO determination algorithms output signal values of 0 or 1 for each of the input n*m exosome SERS signals, and the cancer information providing unit compares an average of the output signal values with a classification reference value for each cancer type to determine each cancer type.

[Claim 5]

A multi-cancer simultaneous diagnosis method using a multi-cancer simultaneous diagnosis system, the multi-cancer simultaneous diagnosis method comprising:

labeling a plurality of first exosome SERS signals obtained from exosomes collected from plasma of a normal person as 0, and labeling a plurality of second exosome SERS signals obtained from exosomes collected from plasma of cancer patients having a plurality of cancer types as 1;

training a cancer classification algorithm, by inputting the labeled plurality of first exosome SERS signals and the labeled plurality of second exosome SERS signals to the cancer classification algorithm, to classify each of the plurality of input first and second exosome SERS signals as 0 or 1;

training each of a plurality of tissue of origin (TOO) determination algorithms respectively corresponding to the plurality of cancer types, by inputting the second exosome SERS signal acquired from a cancer patient having a preset cancer type among the plurality of cancer types and the second exosome SERS signals acquired from other cancer patients excluding the cancer patient having the preset cancer type to the

plurality of TOO determination algorithms, to determine whether an input exosome SERS signal corresponds to the preset cancer type;

dropping exosomes acquired from a measurement target person on a chip to acquire a plurality of exosome surface enhanced Raman spectroscopy (SERS) signals from the chip;

acquiring signal values of 0 or 1 for each of the plurality of exosome SERS signals by inputting the plurality of acquired exosome SERS signals to the trained cancer classification algorithm and diagnosing cancer or normality by using an average of the acquired signal values; and

acquiring the signal values of 0 or 1 for each of the plurality of exosome SERS signals by inputting the plurality of exosome SERS signals to the plurality of trained tissue of origin (TOO) determination algorithms when diagnosed as the cancer, predicting a cancer type by using the average of the acquired signal values, and providing information on the predicted cancer type.