



Skin spectral features of patients with cardiovascular diseases and chronic kidney disease

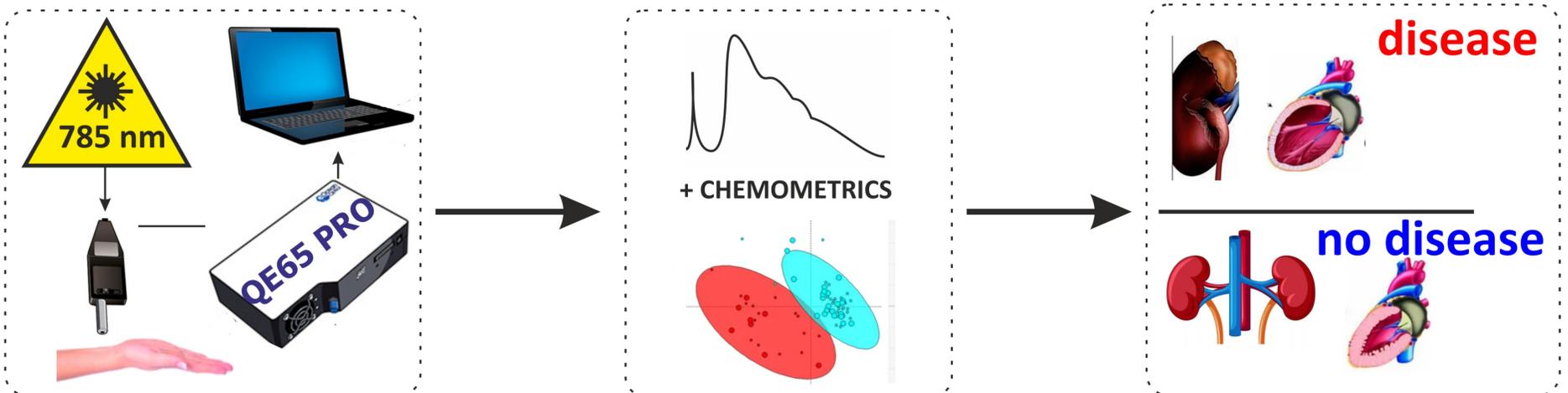
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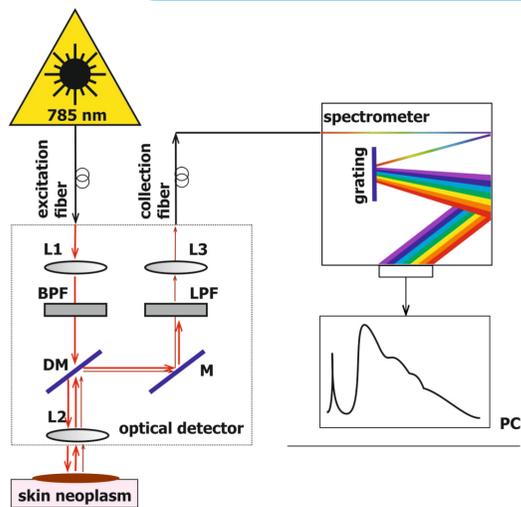
ABSTRACT



MOTIVATION

- Inflammatory and degenerative processes in the heart and kidneys lead to physiological and pathological changes in the chemical composition of biological tissues and biofluids due to metabolic disorders.
- Structural changes in the functional groups of nucleic acids, proteins, lipids and carbohydrates are the most important biomarkers of various non-communicable diseases.
- Raman spectroscopy is the most sensitive optical instrument to the biochemical composition of the biotissue and biofluids.

MATERIALS AND METHODS



In vivo experiment was performed at Samara Regional Clinical Hospital named after V.D. Seredavin, Samara Clinical Hospital named after N.I. Pirogov and Samara National Research University. Noninvasive measurements were performed from forearm skin for each subject.

Analyzed group	Number of subjects	Number of spectra
Patients with cardiovascular disease (CVD)	56	112
Patients with chronic kidney disease	80	95
Control group (healthy adult volunteers)	40	80
In total	176	287

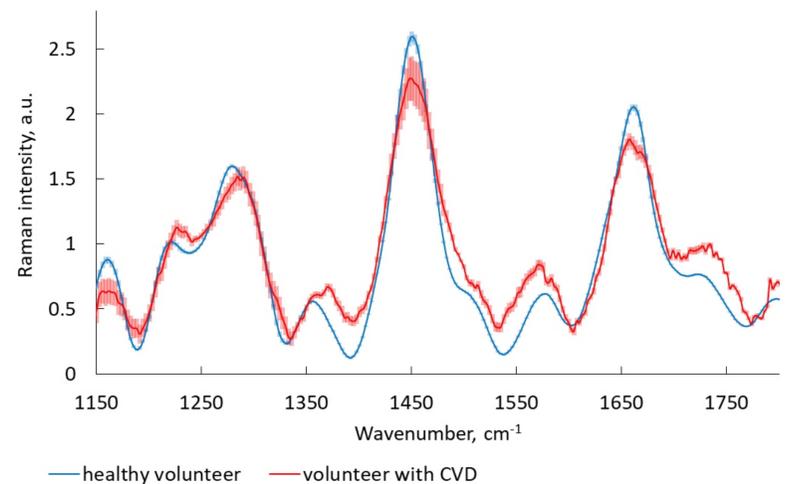
Data preprocessing:

- smoothing by Savitsky-Golay method,
- baseline correction,
- standard normal variation,
- centering.

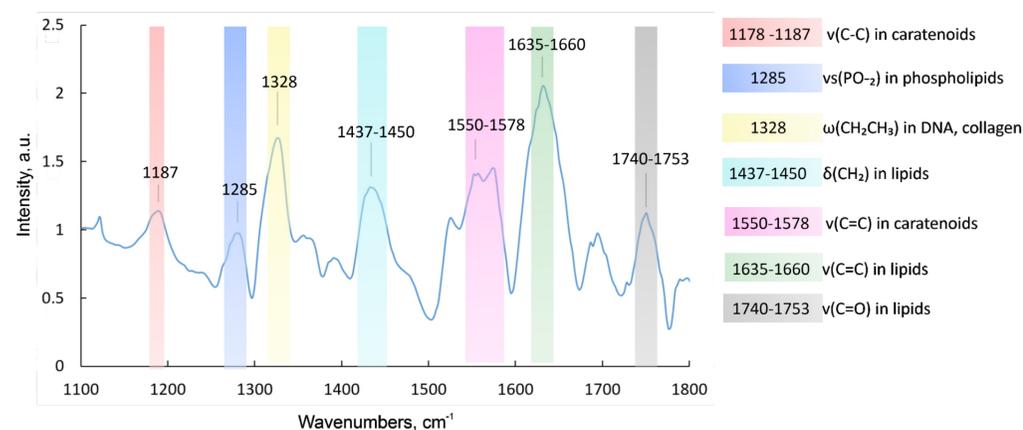
PLS-DA analysis was used to built regression models to classify different skin of patients from different analyzed group. The stability of the PLS-DA models was checked by means of 10-fold cross-validation. Multivariate analysis was carried out with using the MDAtools package in *R studio*.

RESULTS

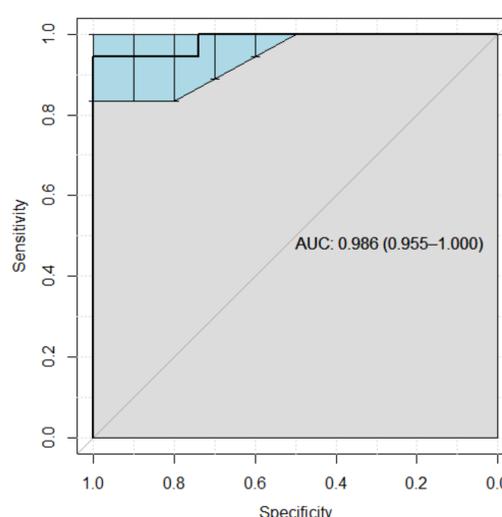
The mean Raman skin spectra with confidence interval



Variables in Important Projection (VIP) analysis makes it possible to assess the impact of individual spectral variables (in region 1200-1800 cm⁻¹) of the predicate matrix array of PLS on the model.



ROC analysis



Based on the identified spectral differences, the spectra of the skin of patients with CVD and the skin of healthy volunteers in the control group were classified. The ROC AUC of this classification was 0.99 (0.99-1.00, 95% CI).