

Project title: Application of artificial intelligence to predict the presence of left atrial appendage thrombus based on transthoracic echocardiography video and clinical data.

Atrial fibrillation is a common heart disease affecting millions of people worldwide. It is characterized by irregular and often rapid heart rate. Although not always life-threatening, atrial fibrillation can lead to serious complications, such as stroke, mainly due to the formation of a thrombus (clot) in the left atrial appendage, which can move with the blood flow and block blood supply to the brain.

In certain clinical situations, it is necessary to detect the presence or confirm the absence of a left atrial appendage thrombus. Standard treatments for atrial fibrillation, such as electrical cardioversion or percutaneous ablation, could pose a risk to the patient if performed in the presence of such a thrombus, as they may cause the clot to detach, leading to a stroke. Therefore, in qualifying patients for such procedures, it is often necessary to perform tests that allow imaging of the left atrial appendage to determine if a left atrial appendage thrombus is present.

The most commonly used diagnostic method in the assessment of the left atrial appendage is transesophageal echocardiography. This effective technique involves inserting an ultrasonographic probe through the throat to image the heart structures. Unfortunately, this method is often associated with significant discomfort for the patient and sometimes can lead to complications related to the insertion of the probe through the throat into the esophagus. This method is also quite time-consuming, requires proper patient preparation, and appropriate sterilization of the probe after each use.

In contrast to transesophageal echocardiography, transthoracic echocardiography is a non-invasive method during which the doctor images the heart by applying an ultrasonographic probe to the surface of the chest. Although this examination cannot directly visualize clots in the left atrial appendage, it can detect numerous changes in the heart indicating an increased risk of their formation. Preliminary studies conducted by our team have shown that manually measured parameters in transthoracic echocardiography, combined with information about accompanying diseases and medications, can predict the presence of a left atrial appendage thrombus with high sensitivity.

In this project, we plan to use the latest achievements in the field of artificial intelligence for automatic analysis of echocardiographic video to predict the risk of clot formation in the left atrial appendage. Predictive artificial intelligence will allow for a quick and repeatable selection of patients who have a high risk of left atrial appendage thrombus formation and perform a transesophageal examination only in this selected group, while foregoing it in patients whose risk of clot formation is very low.

In summary, the project aims to use artificial intelligence for the automatic analysis and integration of imaging data and clinical data, with the goal of creating tools to assess the risk of formation of left atrial appendage thrombus. This has great significance for planning the treatment and also for the prognosis of patients with atrial fibrillation.