

REVIEW

to the Senior Thesis “Multivariate Symbolic Aggregate Approximation for ECG Analysis” by Moritz M. Konarski submitted to the Applied Mathematics and Informatics Program of American University of Central Asia in Partial Fulfillment of the Requirements for the Degree of Bachelor of Arts.

The thesis is devoted to the actual problem comparison of ECG representation methods and their performance for discord discovery. Electrocardiograms are the most common tool used to diagnose heart diseases, which claim more lives each year than any other disease. Since their invention, electrocardiograms needed to be analyzed by a trained professional like a cardiologist. More recently, they can be analyzed using computers and computer-assisted methods. These methods can be more accurate, faster, and more versatile than humans. One time series representation method is the Symbolic Aggregate Approximation (SAX), which transforms an electrocardiogram into a shorter, symbolic form. Its main features are the symbolic representation and dimension reduction of time series data, and the lower bounding of the Euclidean Distance. SAX is faster and simpler to analyze. Multivariate SAX (MSAX) takes more than one electrocardiogram lead into account and should be more sensitive than SAX when it comes to discord discovery using the Heuristically Ordered Time series using SAX (HOT SAX) algorithm. MSAX shares the main features of SAX, but expands them to multivariate time series, such as ECGs. This thesis investigates if MSAX increases the sensitivity of HOT SAX compared to SAX.

Moritz independently proved experimentally using the data base that the performance of MSAX and SAX is not significantly different when they are applied to ECGs. This finding is supported by the paper which introduced MSAX. The authors of that paper found only slight differences in performance. This method allows an ECG to be reduced to a small number of letters. These letters can then be used in HOT SAX to detect discords in an ECG. Such discords can represent medical conditions and their detection can help diagnose those conditions.

In my opinion Moritz Konarski completely fulfilled the problems stated by supervisor. This project was done as a part of the AUCA FRG “Mathematical Model in Acute Cardiac Ischemia Evaluation”. He demonstrated the deep knowledge of mathematics fundamentals and deserves to marked “A” for the Senior Thesis.

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