The use of human-derived preference factors in auto-adaptive ECG interpretation software

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The computer-assisted interpretation of electrocardiogram implies uniformization of the diagnostic procedure [1]. Despite of common acceptance, the uniform procedure does not represent the human expert behavior and therefore has two considerable drawbacks:

- prefers average instead of patient-oriented approach,
- neglects the rules of information flow established in course of the history of medicine and also does not consider the latest achievements of medical sciences.

The use of agile software [2] removes main technological constraints for patient-oriented interpretation and opens for the machine the opportunity for a better simulation of a human expert assistance. The principal challenge, partially considered in our study, is revealing the experts preferences in an objective way. For this studies we applied one of basic principle of metrology requiring that the measurement does not influence the observed process. In practice of our experiments it implies the undisclosed observations of cardiologists behavior during his everyday clinical activity.

Although the topic of the studies covers much wider area, we focused on two human-preference factors having principal impact to the software design. The selected factors are:

- local importance of the ECG record in context of represented phase of the heart cycle,
- importance and hierarchy of dignostic parameters in context of patient status.

The investigations of a local importance of the ECG record was carried out with use of CSE Database-originated [3] and custom-recorded automatically-segmented ECG strips interpreted by the expert equipped with an eyetracker. The interpretation is considered as a visual task and the eye trajectory is representative for the image acquisition and interpretation by the human. The goggles of eyetracking system affect the comfort of the doctor, however excluding first few signal strip, we assume he or she focuss exclusively on the interpretation task.

The research on the patient status-dependent hierarchy of diagnostic parameters was based on a hidden poll. With cooperation with the manufacturer of commercial ECG interpreting software, we replaced the default preselected items included to the final diagnostic report with a random proposal. Each item is attributed by a cost coefficient roughly depending on data volume. Depending on the patient status, the expert willingly selects and deselects items, consequently the cost factors cumulate up to a given threshold inhibiting inclusion of non-relevant data. Recording the selection action and items order we derived the estimate of doctor preferences and correlate it to a patient status.

Both preference factors were applied to a prototype limited-scale wireless cardiac surveillance network yielding a unprecedented flexibility of adaptation justified by medical background.

Bibliography:

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