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A Computer-Human Interaction Model to Improve the Diagnostic Accuracy and Clinical Decision-Making during 12-lead Electrocardiogram Interpretation

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Abstract

Introduction: The 12-lead Electrocardiogram (ECG) presents a plethora of information and demands extensive knowledge and a high cognitive workload to interpret. Whilst the ECG is an important clinical tool, it is frequently incorrectly interpreted. Even expert clinicians are known to impulsively provide a diagnosis based on their first impression and often miss co-abnormalities. Given it is widely reported that there is a lack of competency in ECG interpretation, it is imperative to optimise the interpretation process. Predominantly the ECG interpretation process remains a paper based approach and whilst computer algorithms are used to assist interpreters by providing printed computerised diagnoses, there are a lack of interactive human-computer interfaces to guide and assist the interpreter.

Methods: An interactive computing system was developed to guide the decision making process of a clinician when interpreting the ECG. The system decomposes the interpretation process into a series of interactive sub-tasks and encourages the clinician to systematically interpret the ECG. We have named this model 'Interactive Progressive based Interpretation' (IPI) as the user cannot 'progress' unless they complete each sub-task. Using this model, the ECG is segmented into five parts and presented over five user interfaces (1: Rhythm interpretation, 2: Interpretation of the P-wave morphology, 3: Limb lead interpretation, 4: QRS morphology interpretation with chest lead and rhythm strip presentation and 5: Final review of 12-lead ECG). The IPI model was implemented using emerging web technologies (i.e. HTML5,

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