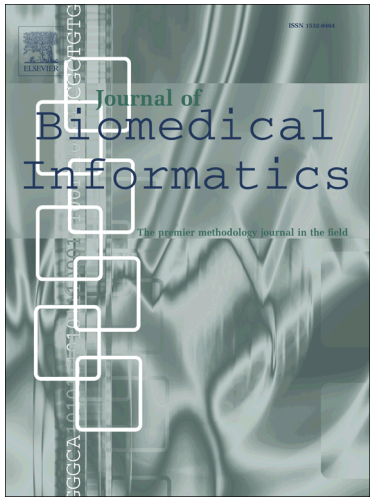

A Computer-Human Interaction Model to Improve the Diagnostic Accuracy and Clinical Decision-Making during 12-lead Electrocardiogram Interpretation

Andrew W Cairns, Raymond R Bond, Dewar D Finlay, Cathal Breen, Daniel Guldenring, Robert Gaffney, Anthony G Gallagher, Aaron J Peace, Pat Henn

PII: S1532-0464(16)30129-0
DOI: http://dx.doi.org/10.1016/j.jbi.2016.09.016
Reference: YJBIN 2650

To appear in: *Journal of Biomedical Informatics*

Received Date: 8 February 2016
Revised Date: 22 September 2016
Accepted Date: 25 September 2016

Please cite this article as: Cairns, A.W., Bond, R.R., Finlay, D.D., Breen, C., Guldenring, D., Gaffney, R., Gallagher, A.G., Peace, A.J., Henn, P., A Computer-Human Interaction Model to Improve the Diagnostic Accuracy and Clinical Decision-Making during 12-lead Electrocardiogram Interpretation, *Journal of Biomedical Informatics* (2016), doi: http://dx.doi.org/10.1016/j.jbi.2016.09.016

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

Andrew W Cairns [1], Raymond R Bond [1], Dewar D Finlay [1], Cathal Breen [1], Daniel Guldenring [1], Robert Gaffney [2], Anthony G Gallagher [2], Aaron J Peace [3], Pat Henn [2],

[1]Ulster University, Northern Ireland, UK, [2] University College Cork, Ireland, [3] Altnagelvin Hospital, Northern Ireland, UK

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,