



**QUEEN'S
UNIVERSITY
BELFAST**

Utilising entropy analysis as a method to assess fetal wellbeing by extracting cardiocography signals: 8332

Topalidou, A., Tzagkarakis, G., & Healy, I. M. (2018). *Utilising entropy analysis as a method to assess fetal wellbeing by extracting cardiocography signals: 8332: COST Action Birth Conference: Lisbon*. Paper presented at From Birth to Health: Towards sustainable childbirth, Lisbon, Portugal.

Document Version:
Other version

Queen's University Belfast - Research Portal:
[Link to publication record in Queen's University Belfast Research Portal](#)

Publisher rights
Copyright 2018 The Authors.

General rights
Copyright for the publications made accessible via the Queen's University Belfast Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
The Research Portal is Queen's institutional repository that provides access to Queen's research output. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact openaccess@qub.ac.uk.

Open Access
This research has been made openly available by Queen's academics and its Open Research team. We would love to hear how access to this research benefits you. – Share your feedback with us: <http://go.qub.ac.uk/oa-feedback>

Utilising entropy analysis as a method to assess fetal wellbeing by extracting cardiotocography signals

George Tzagarakis¹, Anastasia Topalidou², Maria Healy³

¹ R&D dept. Constrat Ltd, Greece / Dept. Electr. Eng. TEI of Crete, Greece

² Research in Childbirth and Health Unit, School of Community Health and Midwifery, Faculty of Health and Wellbeing, University of Central Lancashire

³ School of Nursing and Midwifery, Queens University Belfast

Rationale: Electronic fetal monitoring (EFM) or cardiotocograph (CTG) is a technical recording of the fetal heart rate (FHR) and uterine contractions (UC), undertaken during pregnancy or labour to assess fetal wellbeing. Most of the research relating to EFM has focused on FHR and/or the affect of UC on FHR.

Aim: The aim of the study was the correlation of FHR with UC and fetal movements (FM), based on in depth analysis of anonymous retrospective antenatal CTGs, undertaken between 34-42 weeks of gestation.

Methods: 23 signals fulfilling the inclusion criteria were collected. The length of the signals ranged from 30 minutes to 4 hours. The non-linear dynamic single signal analysis included the mutual information, permutation entropy and Kernel density. For the multiple signals' analysis, the conditional, cross-approximate and cross sample entropy algorithms were used. To assess the linear correlation Pearson correlation coefficient were used.

Results/Conclusion: All signals analysed as pairs (FHR-UC, FHR-FM, UC-FM). Mutual information, permutation entropy and cross approximate entropy algorithms showed statistically significant sequence similarity for FHR-UC. Further segmentation of the signals in 3-10 segments were performed confirming the statistical significance of the results. Important results were obtained from the analysis of the FMs, despite the processing difficulties. The results of this study reinforce the importance of FMs as a method for the assessment of fetal wellbeing.

Implications of findings: This pilot study is the beginning of a series of research projects aimed to offer better understanding of fetal health parameters and following improving maternal and fetal wellbeing.

Key words: Electronic fetal monitoring, signal processing, fetal movements