Title: Machine Learning Approaches for Menstrual Cycle Tracking

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Abstract: The menstrual cycle is a crucial indicator of a woman's overall health. Accurate tracking and forecasting will lead to maintenance of general fitness and early diagnosis of chronic, hormone-dependent disorders of the female reproductive system. In this paper we develop a robust, personalized model that can infer hormone dynamics and predict the onset of menstruation both for healthy individuals and for those with disorders of the reproductive system. We take advantage of physiological signals from minimally invasive wearable medical sensors, specifically, acceleration, electrodermal activity (EDA), galvanic skin response, blood volume pulse and blood pressure for continuous data collection. A thorough data analysis procedure comprising pre-processing, feature extraction and feature selection (forward attribute and Principal Component Analysis) is implemented. The comprehensive set of selected features is fed into base regression algorithms, followed by stacked regression and an ensemble of autoregressive integrated moving average (ARIMA) predictions. The ensemble stacked model trained on the ARIMA integrated feature set accurately predicts the onset of menstruation with an overall root mean square error (RMSE) of 1.17 days. The prediction accuracy goes on increasing as the onset date approaches, with a RMSE of 1.01 days three weeks in advance, 0.21 days with two weeks to go and 0.04 days during the week of menstruation.

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