

RESEARCH ARTICLE

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CNFE-SE: a novel approach combining complex network-based feature engineering and stacked ensemble to predict the success of intrauterine insemination and ranking the features

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Abstract

Background: Intrauterine Insemination (IUI) outcome prediction is a challenging issue which the assisted reproductive technology (ART) practitioners are dealing with. Predicting the success or failure of IUI based on the couples' features can assist the physicians to make the appropriate decision for suggesting IUI to the couples or not and/or continuing the treatment or not for them. Many previous studies have been focused on predicting the in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI) outcome using machine learning algorithms. But, to the best of our knowledge, a few studies have been focused on predicting the outcome of IUI. The main aim of this study is to propose an automatic classification and feature scoring method to predict intrauterine insemination (IUI) outcome and ranking the most significant features.

Methods: For this purpose, a novel approach combining complex network-based feature engineering and stacked ensemble (CNFE-SE) is proposed. Three complex networks are extracted considering the patients' data similarities. The feature engineering step is performed on the complex networks. The original feature set and/or the features engineered are fed to the proposed stacked ensemble to classify and predict IUI outcome for couples per IUI treatment cycle. Our study is a retrospective study of a 5-year couples' data undergoing IUI. Data is collected from Reproductive Biomedicine Research Center, Royan Institute describing 11,255 IUI treatment cycles for 8,360 couples. Our dataset includes the couples' demographic characteristics, historical data about the patients' diseases, the clinical diagnosis, the treatment plans and the prescribed drugs during the cycles, semen quality, laboratory tests and the clinical pregnancy outcome.

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