# A Morphokinetic and Machine Learning Model for Aneuploidy Screening of Human Preimplantation Embryos

Huang, Davey

In vitro fertilization (IVF) involves a complex series of clinical and laboratory procedures with the goal of conceiving a healthy child for infertile couples. The high frequency of chromosomal abnormalities, or aneuploidies, affecting the multiple embryos retrieved for this procedure is a primary challenge for IVF. Implantation of an aneuploid embryo leads to either the death of the embryo or fetus (a failed treatment cycle) or a genetically diseased baby, which are results that incur substantial medical, financial, and psychological costs. Current aneuploidy screening methods, which aim to prevent these outcomes, are highly invasive and expensive, which make them impractical for routine clinical implementation. Therefore the goal of this interdisciplinary study was to develop a simple, non-invasive, inexpensive, and accurate screening model for aneuploidy. This retrospective study discovered new morphokinetic markers for aneuploidy using microscopic time-lapse imaging of in vitro developing embryos. Novel markers associated with blastocyst growth dynamics were discovered to be significantly correlated with aneuploidy. Using these new understandings, a comprehensive machine learning algorithm for aneuploidy screening was developed, which combined multivariate logistic regressions, artificial neural networks, and support vector machines. The ensemble model predicted embryo aneuploidy with high discriminative capabilities on a blind testing set and offered significant improvements over current state-of-the-art screening models. After further validation, this study's aneuploidy screening model could be easily adopted by IVF laboratories to improve clinical treatment and alleviate significant costs.

**Awards Won:**

Intel ISEF Best of Category Award of $5,000

American Statistical Association: First Award of $1,500

Patent and Trademark Office Society: Second Award of $500

China Association for Science and Technology (CAST): Award of $1,200