

Knowledge and masking to address AI bias and performance



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AI bias and performance are significant issues for AI

Impacts scalability (generalizability), reliability and utility of AI when used in clinical practice



Can't just throw data at AI algorithms and expect a good result

AI (machine learning) does not understand the problem or the data

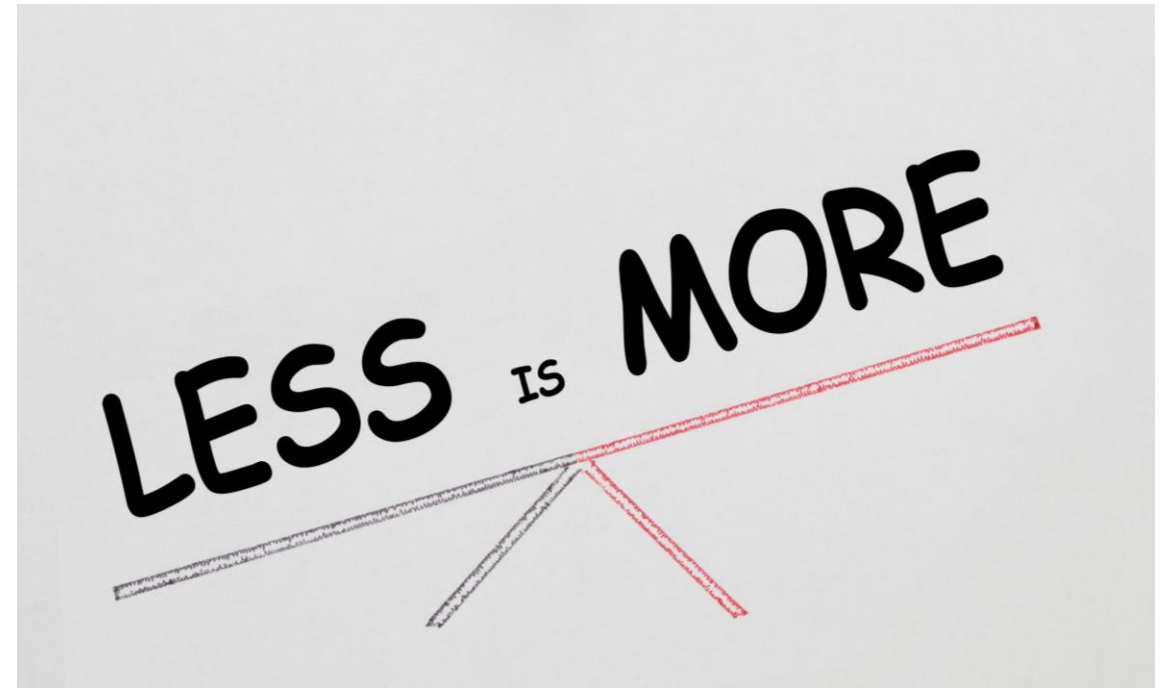
AI simply looks for patterns and features in the data to help you identify or classify something of interest, e.g. cancer in an image



Greater detail in data is not always helpful

Overwhelming details in data cause difficulty for AI (machine learning)

AI can find patterns in irrelevant details that are not important to solving the problem



Example: identifying polar bears in images

Most polar bear images contain snow

Rather than learn to identify polar bears, the AI may learn images containing snow are polar bears



AI does not always find what it is looking for on its own

Knowledge of the problem and data helps to design and target the AI

Masking helps eliminate irrelevant details that may confuse AI, and focus on what's important



How does it help with bias?

Example: Potatoes and Carrots

Easy to distinguish with
different shape and color



How does it help with bias?

Example: Potatoes and Carrots

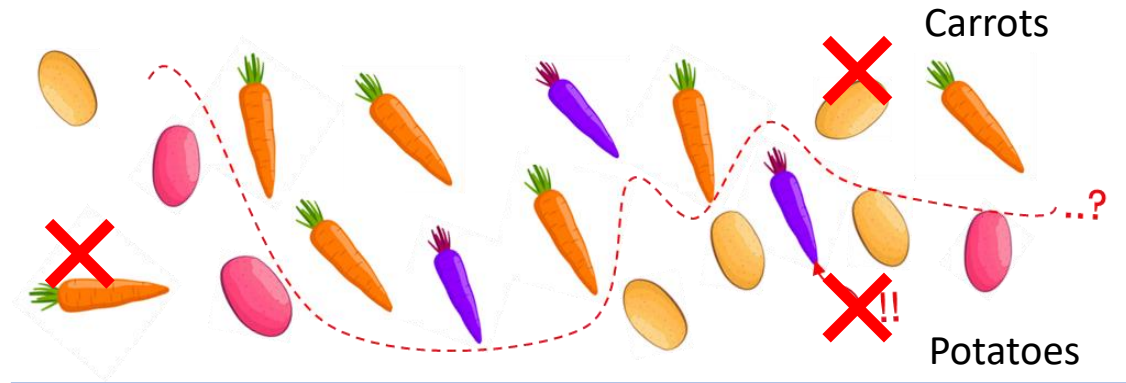
Easy to distinguish with different shape and color?

AI focusing on color can produce unexpected results



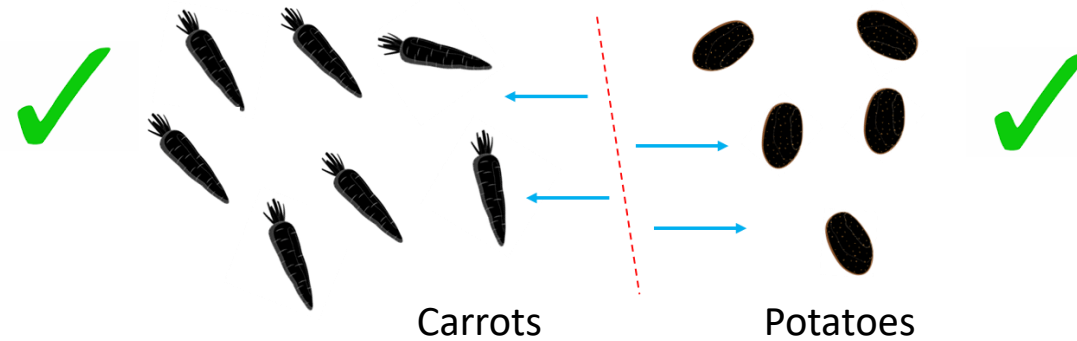
Masking can help eliminate impact of color influencing identification of potatoes and carrots

No Masking



Color confuses the AI

Masking



Eliminate color as a factor
= better performing AI

Real world medical example: images of embryos in IVF

Use AI to assess embryo:

Viability

Likelihood that the embryo will lead to a pregnancy for the IVF patient

Genetic Integrity

Likelihood that the embryo is genetically normal

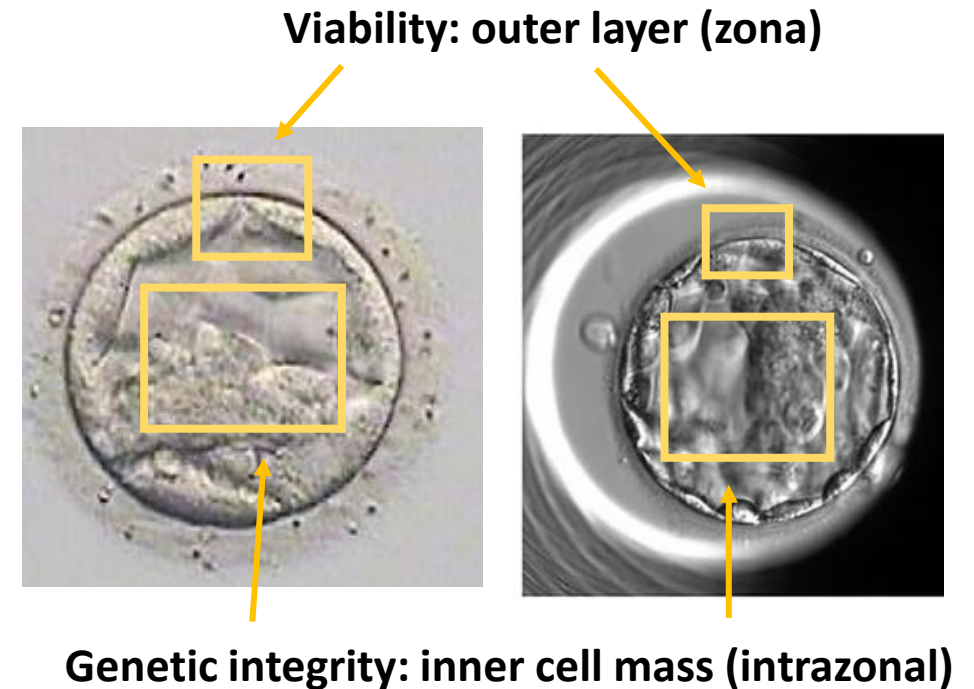


Images of embryos

Real world medical example: images of embryos in IVF

AI Performance

Different parts of the embryo are important for assessing their viability (likelihood of pregnancy for IVF patient) and genetic integrity



Real world medical example: images of embryos in IVF

AI Performance

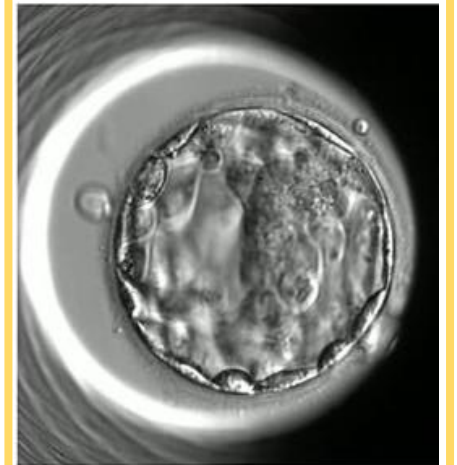
Different parts of the embryo are important for assessing their viability (likelihood of pregnancy for IVF patient) and genetic integrity

AI Bias

Images from different camera systems look different, with potential for hardware bias



**Standard Microscope
Camera**



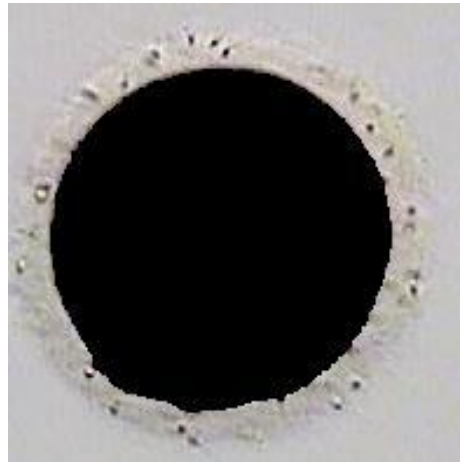
**Time-Lapse
Incubator**

Masking helps target AI on what is important to improve embryo AI performance and reduce bias

Whole embryo



Zona Segmentation



IntraZonal Segmentation



Augmentation also helps eliminate potential bias from embryo orientation or color

Different colors synthetically imposed on the same image



Different flips and rotations imposed on the same image



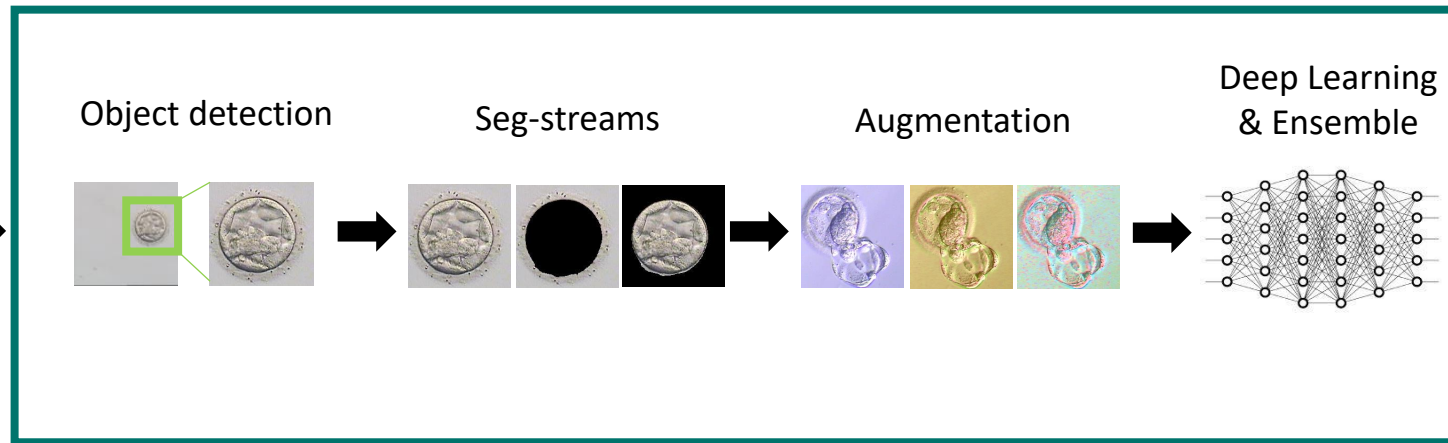
Creating an AI for embryo assessment

Training Dataset
(Non-time lapse images only)

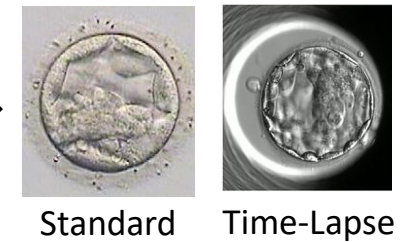


+
Pregnancy or Genetic
Outcomes

Model Training Pipeline



Testing on Different
Imaging Types



Unbiased AI clinically validated on camera systems it was not trained on

Camera-agnostic self-annotating Artificial Intelligence (AI) system for blastocyst evaluation

M. VerMilvea^{1,2}, J.M.M. Hall^{3,4}, S. Diakiw⁴, A. Johnston^{3,4}, T. Nguyen⁴, M.A. Dakka⁴, A. Lim⁵, W. Quangkananurug⁶, D. Perugini⁴, A.P. Murphy⁴, M. Perugini⁴.

Matthew (Tex) VerMilvea, PhD, HCLD/CC (ABB)
Vice President of IVF Lab Operations; Ovation Fertility
Scientific Director; Texas Fertility Centers




Presented at ESHRE 2020

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RBMO
ARTICLE

An artificial intelligence model correlated with morphological and genetic features of blastocyst quality improves ranking of viable embryos

BIOGRAPHY
Dr Michelle Perugini is a health technology entrepreneur with extensive experience in healthcare and advanced artificial intelligence technologies. She is an avid supporter of artificial intelligence and women's health sectors globally. Dr Perugini has a PhD in medicine and was a post-doctoral research fellow in oncology for a decade.

Sanya M. Diakiw¹, Jonathan M.M. Hall^{1,3}, Matthew VerMilvea^{1,2}, Adelle Y.K. Lim¹, Winit Quangkananurug¹, Sujin Chanchanont¹, Brandon Bankowski¹, Rebecca Stone¹, Anikah Stone¹, Andrew Miller¹, Glen Adams¹, Raeanne van Tol¹, Roberts Homan¹, Jon Alquist¹, Lydia Gianfranceschi¹, Adrian Johnson¹, Tee Vee Nguyen¹, Mital A. Dakka¹, Don Perugini¹, Michelle Perugini¹

KEY MESSAGE
Improved methods for evaluating artificial intelligence in the field of IVF are described. The importance of correlating intelligence scores with known parameters of embryo quality for artificial intelligence characterization is highlighted. The findings support artificial intelligence testing methods and use in clinical practice.

ABSTRACT
Research question: Can better methods be developed to evaluate the performance and characteristics of an artificial intelligence model for evaluating the likelihood of clinical pregnancy based on analysis of day 5 blastocyst stage embryos, such that performance evaluation more closely reflects clinical use in IVF procedures, and correlates with known features of embryo quality are identified?
Design: Six identified images were provided retrospectively or collected prospectively by IVF clinics using the artificial intelligence model in clinical practice. A total of 9259 embryos were provided by 18 IVF clinics across six countries, from 4709 women who underwent IVF between 2011 and 2021. Main outcome measures included clinical pregnancy.

Development of an artificial intelligence model for predicting the likelihood of human embryo euploidy based on blastocyst images from multiple imaging systems during IVF

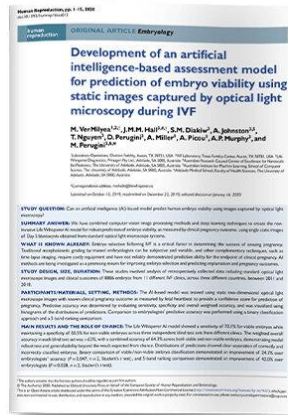
S.H. Shaker^{1,2}, J.M.M. Hall^{1,3}, M.D. VerMilvea^{1,2}, J. Anon⁴, R. Alqarni¹, L. Gianfranceschi¹, Y.G. Brouzos¹, A.Y. Lim¹, M.A. Dakka¹, T.M. Higgins¹, D. Perugini¹, and M. Perugini¹

KEY MESSAGE
Development of an artificial intelligence model for predicting the likelihood of human embryo euploidy based on blastocyst images from multiple imaging systems during IVF is described. The findings support artificial intelligence testing methods and use in clinical practice.

AI performance for embryo assessment based on international clinical studies

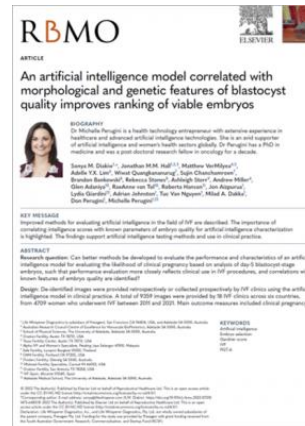
25%

Increased accuracy for pregnancy prediction



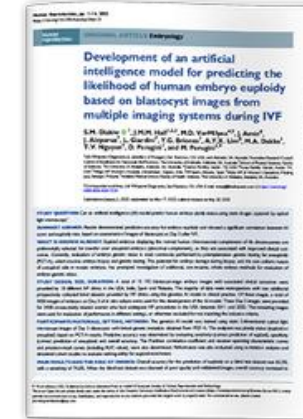
12%

Reduction in cycles needed to achieve pregnancy*



82%

Probability of selecting a genetically normal embryo*



* Using simulated cohort ranking analyses.

* Using simulated cohort ranking analyses. Genetic status was evaluated based on an embryo having the correct number of chromosomes.

- Life Whisperer AI is only available for sale to healthcare professionals -

Knowledge and masking can help improve AI performance and reduce bias

For healthcare, it improves scalability (generalizability), reliability and utility of AI when used in clinical practice

Helps ensure AI is applicable to everyone





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