Supplementary Materials

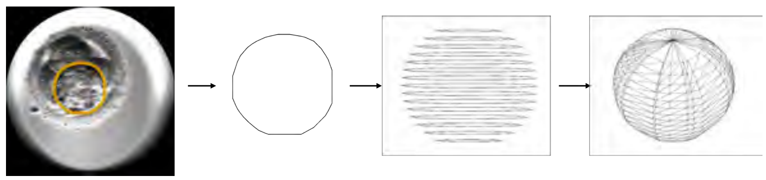

Fig. 1. Illustration of the mesh generation process. From left to right: (1) a cell is segmented at its most in-focus plane; (2) the cell outline is converted into a polygon; (3) copies of the polygon are generated above and below the equatorial polygon, getting smaller the further away they are; (4) a mesh is produced by generating triangles between the polygon vertices.

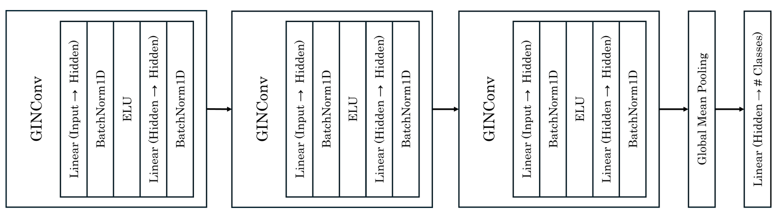

Fig. 2. A GNN architecture. Input and output dimensions for linear layers are provided in parentheses. Specific layer sizes used in our experiments can be found in Table 2.

Fig. 3. Comparison of perspective (left) and orthographic (right) camera projections when used to view 3D reconstructions.

Table 1. Breakdown of datasets used in each experiment. All data was collected between 2018 and 2021. The American and Belgian clinics provided 11 focal planes whereas the French clinic only provided 7. The segmentation model was trained on a mixture of the three clinic datasets, stratified by cell count. The GNN experiment used t8 focal stacks from 80 euploid embryo transfers conducted at the American clinic (the only clinic which provided ploidy data) which led to 44 live births. All clinics used Embryoscope time-lapse incubators.

Experiment	**Phase**	**Clinic**	**N**
Segmentation Model	Training and Cross-Validation	American	309
		Belgian	102
		French	87
	NMS Hyperparameter Tuning	American	38
		Belgian	4
		French	50
	Testing	American	8
		Belgian	32
		French	2
User Study	Reconstruction Rating	American	15
GNN	Training and Cross-Validation	American	80

Table 2. Hyperparameter values and search strategies for each experiment. GS = Grid Search; MC = Memory Considerations; BO = Bayesian Optimisation; DK = Domain Knowledge. Bayesian optimisation was performed over 100 trials using the Optuna framework (v3.4.0).

Experiment	**Hyperparameter**	**Value**	**Selection Method**	**Search Range (if applicable)**
Segmentation Model Training	SGD Learning Rate	0.005	GS	$\{0.01, 0.005, 0.001\}$
	SGD Momentum	0.9	GS	$\{0, 0.9, 0.99\}$
	SGD Weight Decay	0.0005	GS	$\{0, 0.0005, 0.005\}$
	SGD Batch Size	8	MC	-
NMS Thresholds	Classic NMS IoU	0.6	GS	$\{0.6, 0.7, 0.8, 0.9\}$
	Classic NMS Confidence	0.8	GS	$\{0.6, 0.7, 0.8, 0.9\}$
	Crowd NMS IoU	0.6	GS	$\{0.6, 0.7, 0.8, 0.9\}$
	Stack NMS IoU	0.6	GS	$\{0.6, 0.7, 0.8, 0.9\}$
	Stack NMS Confidence	0.8	GS	$\{0.6, 0.7, 0.8, 0.9\}$
	Stack NMS Window Size	1	DK	-
Graph Neural Network	MLP Hidden Layer Size	32	BO	2ˆ[0, 11]
	Number of Graph Convs	3	BO	$\{1, 2, 3\}$
	Graph Conv Operator	GINConv	GS	{GCNConv, GINConv}
	Adam Learning Rate	8.9e-3	BO	10ˆ[-5, 0]
	Adam Weight Decay	1.5e-2	BO	10ˆ[-5, 0]