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Conference Program

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## Towards Automated Early Classification of Embryos

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### Abstract

The early classification of embryos observed in time-lapse video is a challenging issue (1). On the one hand high success after transfer is looked for, on the other hand eliminating good embryos is a problem. Herein we propose a three steps strategy: Annotation, Selection of the most important factors, Automation of the annotation for selected factors.

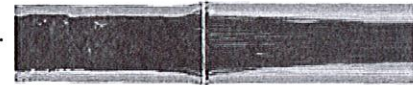
**Annotation:** Dataset of 178 embryos observed by PrimoVision videomicroscopy for 6 to 8 days after fecundation every 15mn. Each embryo is annotated by an expert on morphological and kinetic traits all along the development (150 quantitative or qualitative traits).

**Selection with Random Forest (a) and VSURF (b):** Classification issue along dead or alive state is considered. Classification trees (R package *randomforest* (2)) are estimated as well as selection of variables for interpretation and prediction based on the mean decrease Gini homogeneity measure (VSURF R package). In the prediction proposal *VSURF* (3) exhibits a subset of least correlated predictors. Several predictors rely on the evaluation of dead cells.

**Deciding of dead cells:** The typical phenotype of a death cell event rests upon the swelling of the cell, the loss of texture activity inside the cell and the rupture of the cell wall (Fig. 1). We propose a sampling strategy investigating the occurrence of death inside an embryo along the development. A fix number of locations are sampled on several rays originating from the center and cross-sections along time for each of these rays are analyzed with respect to texture (4). Simple filters based on the estimation of variation coefficient on a variable neighborhood oriented along the time dimension are proposed.

**Main Results:** Automated selection of important features on a new collection of annotated bovine embryos.

**Fig. 1.** A cross-section in a video, occurrence of dead cells (in red).



### References

1. C. Manna, L. Nanni, A. Lumini, S. (2013). Artificial intelligence techniques for embryo and oocyte classification. *IEEE Transactions on Image Processing* 26(1):42-49
2. L. Breiman (2001). Random Forests. *Machine Learning* 45(1):5-32.
3. R. Genuer, J.-M. Poggi, C. Tuleau-Malot (2015). An R Package for Variable Selection Using Random Forests. *The R journal* 7(2):19-33.
4. J. Yuan, D.L. Wang, A.M. Cheriyyadat (2015). Factorization-based texture segmentation. *Machine Learning* 24(11):3488-3497.