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Assignment of bachelor's thesis

Title:	Video Recording based Sperm Cell Movement Prediction and Modes of Movement Detection
Student:	Matej Kulháň
Supervisor:	Ing. Miroslav Čepek, Ph.D.
Study program:	Informatics
Branch / specialization:	Artificial Intelligence 2021
Department:	Department of Applied Mathematics
Validity:	until the end of summer semester 2024/2025

Instructions

The University of Twente (UT) and the University of Waterloo (UW) are working on research into sperm movement. This thesis aims to help the UT and UW teams understand and predict movements of sperm cells. The thesis will study the machine learning approaches to predict future movements of individual cells and will explore ways to identify and extract movements or styles determining the direction and speed of travel. The basis for the thesis are video recordings obtained from UT and UW teams. The thesis will explore approaches based on features explicitly extracted from the recorded video as well as pure image and video processing approaches.

Individual steps:

1. Conduct a literature review and review the current state of the art.
2. Use and adapt previous work to process the video recordings.
3. Review and explore techniques for movement prediction and next frame predictions.
4. Experiment with techniques based on past positions only.
5. Experiment with selected techniques incorporating additional information: extracted features, direct video input.
6. Using techniques for model explainability identify important features and parts of video input for future movement prediction.
7. Document the accuracy of individual approaches.

Electronically approved by Ing. Magda Friedjungová, Ph.D. on 12 February 2024 in Prague.

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Literature:
[1] Noy, Lioz, et al. "Location Prediction of Sperm Cells Using Long Short-Term Memory Networks." Advanced Intelligent Systems 5.9 (2023): 2300161.
[2] OKUMUŞ, F., KOCAMAZ, F., & ÖZGÜR, M. E. (2021). Using polynomial modeling for calculation of quality parameters in computer assisted sperm analysis. Computer Science, 6(3), 152-165. https://doi.org/10.53070/bbd.999296

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