Artificial Intelligence for Sliding Sign Detection to Diagnose Endometriosis

Maicas G [1] , Condous G [2] , Leonardi M [2] , Avery J [3] , Panuccio C [4] , Carneiro G [1] , Hull M [5,6,7]

[1] Australian Institute for Machine Learning, School of Computer Science, University of Adelaide, Adelaide South Australia, Australia

[2] Acute Gynaecology, Early Pregnancy and Advanced Endosurgery Unit, Sydney Medical School Nepean, University of Sydney, Sydney New South Wales, Australia

[3] Adelaide Medical School, University of Adelaide, Adelaide South Australia, Australia

[4] Specialist Imaging Partners, North Adelaide South Australia, Australia

[5] Robinson Research Institute, University of Adelaide, Adelaide South Australia, Australia

[6] Embrace Fertility, 266 Melbourne Street, North Adelaide South Australia, Australia

[7] Women's and Children's Hospital, North Adelaide South Australia, Australia

Objective: (maximum of 50 words) Endometriosis diagnosis from transvaginal ultrasound videos (USV) is useful due to its cost-effectiveness and non-invasiveness, but requires expertise not commonly available in clinics. Patients and clinicians can benefit from an automated diagnosis procedure. We introduce a computer-aided diagnosis (CAD) system that can automatically diagnose endometriosis from USV at expert level.

Design: (maximum of 50 words) Two expert sonologists recorded USV and classified the pouch of Douglas obliteration state according to the sliding sign technique. The absence of the sliding of the bowel against the posterior uterus/cervix was considered indicative of endometriosis. We introduce a CAD system that can classify the 'sliding sign' to predict endometriosis.

Materials and methods : (maximum of 50 words) We used a data set containing 317 USV (260 normal, 57 abnormal) to develop and test our system. We implemented a state-of-the-art video analysis pipeline that outputs a probability of endometriosis. We used the area under the ROC curve (AUC) and classification accuracy to evaluate our method.

Results: (maximum of 125 words) We used 79 out of the 317 videos in the data set to evaluate our system. The proportions of positive and negative videos in the test set are similar to that of the entire data set. Our proposed CAD system achieved an area under the ROC curve (AUC) of 0.81 and a classification accuracy of 0.82 on previously unseen USV.

Conclusion: (maximum of 50 words) Our newly proposed CAD system produces an accurate diagnosis of endometriosis from USV. We hypothesize that the AUC of the diagnosis can be

improved with a larger data set to train our system. Thus, a CAD system has the potential to produce cost-effective and non-invasive automated endometriosis diagnosis from USV.

Keywords: (maximum of 3): endometriosis, artificial intelligence.