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Generalisability of fetal ultrasound deep learning models to low-resource imaging settings in five African countries

Carla Sendra-Balcells[1]✉, Víctor M. Campello[1]✉, Jordina Torrents-Barrena[2], Yahya Ali Ahmed[3], Mustafa Elattar[4,5], Benard Ohene-Botwe[6,7], Pempho Nyangulu[8], William Stones[8], Mohammed Ammar[9], Lamya Nawal Benamer[10], Harriet Nalubega Kisembo[11], Senai Goitom Sereke[12], Sikolia Z. Wanyonyi[13], Marleen Temmerman[14], Eduard Gratacós[15,16,17], Elisenda Bonet[15,18], Elisenda Eixarch[15,16,17], Kamil Mikolaj[19], Martin Grønnebæk Tolsgaard[19] & Karim Lekadir[1]

Most artificial intelligence (AI) research and innovations have concentrated in high-income countries, where imaging data, IT infrastructures and clinical expertise are plentiful. However, slower progress has been made in limited-resource environments where medical imaging is needed. For example, in Sub-Saharan Africa, the rate of perinatal mortality is very high due to limited access to antenatal screening. In these countries, AI models could be implemented to help clinicians acquire fetal ultrasound planes for the diagnosis of fetal abnormalities. So far, deep learning models have been proposed to identify standard fetal planes, but there is no evidence of their ability to generalise in centres with low resources, i.e. with limited access to high-end ultrasound equipment and ultrasound data. This work investigates for the first time different strategies to reduce the domain-shift effect arising from a fetal plane classification model trained on one clinical centre with high-resource settings and transferred to a new centre with low-resource settings. To that end, a classifier trained with 1792 patients from Spain is first evaluated on a new centre in Denmark in optimal conditions with 1008 patients and is later optimised to reach the same performance in five African centres (Egypt, Algeria, Uganda, Ghana and Malawi) with 25 patients each. The results show that a transfer learning approach for domain adaptation can be a solution to integrate small-size African samples with existing large-scale databases in developed countries. In particular, the model can be re-aligned and optimised to boost the performance on African populations by increasing the recall to 0.92 ± 0.04 and at the same time maintaining a high precision across centres. This framework shows promise for building

[1]Departament de Matemàtiques i Informàtica, Universitat de Barcelona, Barcelona, Spain. [2]HP Inc., Barcelona, Spain. [3]Obstetrics and Gynecology Department, School of Medicine, Suez University, Suez, Egypt. [4]Medical Imaging and Image Processing, Center of Informatics Science, Nile University, Sheikh Zayed City, Egypt. [5]Research and Development Division, Intixel, Cairo, Egypt. [6]Department of Radiography, School of Biomedical and Allied Health Sciences, College of Health Sciences, University of Ghana, Accra, Ghana. [7]Division of Midwifery and Radiography, School of Health and Psychological Sciences, University of London, London, UK. [8]Kamuzu University of Health Sciences, Blantyre, Malawi. [9]Department of Electrical Engineering Systems, Laboratory of Engineering System and Telecommunication, University of M'Hamed Bougara Boumerdes, Algiers, Algeria. [10]Obstetrics and Gynecology Department, School of Medicine, Algiers University, Algiers, Algeria. [11]Department of Radiology, Mulago National Referral and Teaching Hospital, Kampala, Uganda. [12]Department of Radiology and Radiotherapy, School of Medicine, Makerere University College of Health Sciences, Kampala, Uganda. [13]Department of Obstetrics and Gynaecology, Aga Khan University Hospital, 3rd Parklands Avenue, Nairobi, Kenya. [14]Centre of Excellence in Women and Child Health, Aga Khan University, Nairobi, Kenya. [15]BCNatal Fetal Medicine Research Center, Hospital Clínic and Hospital Sant Joan de Déu, Universitat de Barcelona, Barcelona, Spain. [16]Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), Barcelona, Spain. [17]Centre for Biomedical Research on Rare Diseases (CIBER-ER), Barcelona, Spain. [18]Barcelona Tech, Universitat Politècnica de Catalunya, Barcelona, Spain. [19]Copenhagen Academy for Medical Education and Simulation and Department of Obstetrics, Rigshospitalet, Copenhagen, Denmark. ✉email: carla.sendra@ub.edu; victor.campello@ub.edu