Testing a deep learning algorithm for automatic detection of prenatal ultrasound for under-resourced communities

Marika Toscano[1], MD; Junior Arroyo[2], BS; Ana C. Saavedra[2], BS; Thomas J. Marini[3], MD; Timothy M. Baran[3], PhD; Kathryn Drennan[1], MD; Ann M. Dozier[4], PhD; Lorena Tamayo[5],BS; Tina Zhao[6], MD; Benjamin Castaneda[2], PhD.

Introduction

In rural and under-resourced communities, the scarcity of Obstetric ultrasound (OB US) imaging results in a considerable gap in the perinatal healthcare.

Objective

To test a new automated diagnostic framework performed without an experienced sonographer or interpreting provider for assessment of fetal biometry measurements, fetal presentation, and placental position.

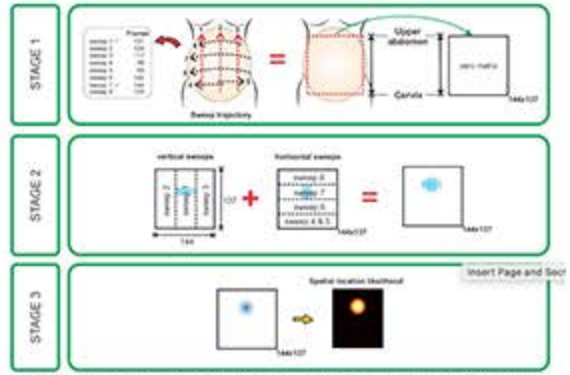
Methods

- A standardized volume sweep imaging (VSI) protocol based solely on external body landmarks was used to obtain OB USN without an experienced sonographer
- A deep learning algorithm (U-net) was trained to automatically segment the fetal head and placental location from VSI OB US to evaluate fetal biometry, fetal presentation, and placental position without a radiologist

A deep learning algorithm accurately predicts fetal presentation, placental location, and fetal biometry from ultrasound images obtained by individuals without prior ultrasound training.

This offers a promising means for expanding access to vital Obstetric ultrasound imaging in rural and under-resourced areas.

Fig 1. Scheme for the generation of the spatial location likelihoods

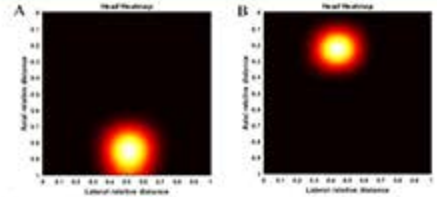


Stage 1: Volume sweep imaging (VSI) protocol (depicted by arrows) is performed on gravid abdomen by ultrasound-naïve operator with 8 hours of training and guided solely by external body landmarks.

Stage 2: Deep learning algorithm applied, with frames containing the target region (in this case fetal head) colored

Stage 3: A Gaussian filter is applied to produce the spatial location likelihood. Based on this map, our algorithm produces a diagnosis: non-cephalic fetus

Fig 2. Heatmaps of cephalic (A) and non-cephalic (B) presentation.



Color signal corresponds to location of fetal head.