AUTOMATED MEASUREMENT OF FETAL HEAD CIRCUMFERENCE IN ULTRASOUND IMAGES

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ABSTRACT

Ultrasound imaging is widely used for screening and monitoring pregnant women. In ultrasound screening biometric measurements, like the crown-rump length, Head Circumference (HC), abdomen circumference and femur length are often computed to determine the Gestational Age (GA) of a fetus and to monitor the growth of a fetus. These measurements are usually obtained manually and this leads to inter- and intra-reader variability. An automated system could potentially reduce measuring time and variability, and assist less-experienced human observers. In this work we focus on automated measurement of the HC.

The automated system consists of three steps. First, a set of Haar-like features [2] was used to train a Random Forest classifier [3] to find the skull. Second, the fetal head was extracted using Hough transform [4] and dynamic programming. Finally, an ellipse was fitted through the dynamic program result to compute the HC. The system was evaluated on 335 ultrasound images. An experienced sonographer manually annotated the HC in each ultrasound image. A reference GA was obtained in the first trimester of the pregnancy with the use of the crown-rump length.

The difference between the automated measured HC of the automated system and the manually annotated HC was 0.6 ± 4.3 mm. The difference between the reference GA and the GA obtained from the manually annotated HC was 0.5 ± 6.1 days. The difference between the reference GA and the GA obtained from the measured HC of the automated system was 1.3 ± 7.5 days.

With the use of our system it is possible to automatically measure the HC and estimate the GA of a fetus. This system could potentially aid less-experienced human observers in developing countries, where there is a severe shortage of well-trained sonographers.

REFERENCES

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