

AUTOMATIC DETECTION AND MEASUREMENT OF FETAL NUCHAL TRANSLUCENCY FROM 3D ULTRASOUND DATA

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ABSTRACT

An estimated 130 million babies are born each year. Unfortunately, 6 percent of them are born with a serious genetic or partially genetic origin defect. Serious birth defects can cause lifelong disability or even death. Prenatal ultrasound screening is aimed at lowering the rate of birth defect. Nowadays, ultrasonography has been widely used in fetal prenatal screening because of its safety, low cost, non-invasive nature and portability. The use of 3D ultrasound imaging in clinic is expanding, as 3D images are more intuitive and provide more spatial information.

My PhD research is to find an automatic method to detect and measure important parameters from 3D fetal ultrasound data, and to help doctors diagnose faster and more accurately. The nuchal translucency (NT) thickness is defined as the maximum distance between the upper and lower high-intensity boundaries of the NT region in the mid-sagittal plane. The thickness of NT in the first trimester of pregnancy has proved to be one of the most important parameters. A high proportion of fetuses with Turner's syndrome and triploidies have an NT thickness of at least 3 mm. Even in the normal karyotype cases, the NT thickness is also associated with structural defects and genetic syndromes risk. In clinic, the measurement of the NT is usually carried out by doctors. The standard mid-sagittal plane needs to be identified firstly. Then, in the 2D image of the mid-sagittal plane, the NT region should be located. Finally the NT thickness will be measured in the NT region. These operations may require highly skilled operators and are often time-consuming. I'm looking for a method to complete the whole measurement process in an automatic way. There are some existing researches on some of the steps involved, which mainly concentrate on locating the NT region from the mid-sagittal plane and automatically measure the NT thickness with the ROI chosen manually. Few researches are focused on automatic detection of the mid-sagittal plane from 3D ultrasound data. Actually, searching for the mid-sagittal plane is the most time-consuming step in the entire process of the NT measurement. If the measurement is not done on the mid-sagittal plane, the thickness of NT may be 40-50% bigger or smaller than the true value. My work starts from the acquired 3D ultrasound data. First, the position of fetal head is roughly located by using a deep learning method. Then, the more accurate position and size of the fetal head is detected by a circle detection method, which is followed by detection of the mid-sagittal

plane based on the symmetry of the fetal head. Next, the ROI region of the NT measurement is determined. And finally, the measurement is done in the NT region. By using the computer to automatically detect and measure NT, the entire process can be fast and accurate, providing helps for the clinic diagnosis.