Data Article

The JNU-IFM dataset for segmenting pubic symphysis-fetal head

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ABSTRACT

The use of transperineal ultrasound techniques for the assessment of fetal head descent and progression is an adjunct to clinical examination. Automatic identification of parameters based on ultrasound images will greatly reduce the subjectivity and non-repeatability of the clinician's judgment. However, the lack of a pubic symphysis-fetal head dataset hinders the development of algorithms. Here, we present an intrapartum transperineal ultrasound dataset of the Intelligent Fetal Monitoring Lab of Jinan University (named the JNU-IFM dataset), in which intrapartum transperineal ultrasound videos of 78 were recorded from 51 patients. These data were obtained with the Youkey D8 wireless 2D ultrasound probe with its corresponding supporting software by Wuhan Youkey Bio-Medical Electronics Co., Ltd., Wuhan, China. In these videos, 6224 high-quality images with four categories were selected to form the JNU-IFM dataset. These images were labelled using the Pair software and then validated by two experienced radiologists. We hope that this
Specifications Table

| Subject                  | Obstetrics, Midwifery and Women’s Health |
|--------------------------|------------------------------------------|
| Specific subject area    | The use of transperineal ultrasound techniques for the assessment of fetal head descent and progression is an adjunct to clinical examination. |
| Type of data             | Image                                    |
| How the data were acquired | Data was obtained from transperineal ultrasound examinations that were performed in standard B-mode ultrasound using the Youkey D8 wireless 2D ultrasound probe with its corresponding supporting software (Wuhan Youkey Bio-Medical Electronics Co., Ltd., Wuhan, China). Data were labelled using the Pair software (Shenzhen Duying Medical Technology Co., Ltd., Shenzhen, China) and then validated by two experienced radiologists. |
| Data format              | Raw                                      |
| Parameters for data collection | The dataset includes intrapartum transperineal ultrasound (ITU) images and the corresponding segmentation labels of symphysis pubis (SP)-fetal head. In addition, four categories respectively corresponding to SP-fetal head images (SPHead) and other images (None: no SP and fetal head, OnlySP: no fetal head and OnlyHead: no SP) are included. |
| Description of data collection | The transducer was prepped by covering it with a surgical latex glove filled with coupling gel, then the prepped transducer, after applying gel, was placed between labia below the pubic symphysis to obtain a sagittal plane, small adjustments in the form of lateral movements of the probe were made until an image obtained showed clear maternal pelvic (pubic symphysis) and fetal (fetal skull) landmarks that did not show any shadows from the pubic rami. A total of 78 videos from 51 pregnant women were collected from NanFang Hospital of Southern Medical University between 2019 and early 2020. 6224 images are extracted from videos in 10 frames each. Images were labelled by using the software Pair. |
| Data source location     | College of Information Science and Technology, Jinan University, Guangzhou, 510,632, China. |
| Data accessibility       | Repository name: JNU-IFM                  |
| Related research article | Zhou M, Yuan C, Chen Z, et al. Automatic Angle of Progress Measurement of Intrapartum Transperineal Ultrasound Image with Deep Learning[C]//International Conference on Medical Image Computing and Computer-Assisted Intervention. Springer, Cham, 2020: 406–414.10.1007/978-3-030-59725-2_39 |

Value of the Data

- The use of intrapartum transperineal ultrasound (ITU) techniques for the assessment of fetal head descent and progression is an adjunct to clinical examination. Compared with subjective judgment and uncertain reproducibility of clinical examination, ITU has the advantages of being well reproducible and objective.
- Manual segmentation of symphysis pubis (SP)-fetal head from ITU images for clinical radiologists is considered as the most reliable but extremely time-consuming procedure prone to subjectivity and large inter-observer variability. With the rapid development of artificial intelligence in medical images, automatic measurement algorithms based on ITU images are expected to solve the above problems.
• This dataset with ITU images and their labels is useful for developing and evaluating automated SP-fetal head segmentation algorithms and image classification algorithms. Although the SP-fetal head identification plays an important role in computing angle of progression (AoP) to assess the descent of the fetal head during labor, this dataset can also be used as objective and quantitative indicators for evaluating other ITU parameters and tracking their efficacy.

1. Data Description

This dataset is publicly available at https://doi.org/10.6084/m9.figshare.14371652, which can be downloaded as a zip file. In the unzip file, 78 files are named as “AAAABBCCTDDEEFF” which is the time when the data was obtained. In detail, AAAA, BB, CC, DD, EE and FF represents year, month, day, hour, minute and second, respectively. In the “AAAABBCCTDDEEFF” file, three folders named as “image”, “mask”, and “frame_label.csv” are listed. The “image” folder contains the original images which are saved in the PNG format and named as “AAAABBCCTDDEEFF_G.png” (G indicates which frame the image is in the video). And the “mask” folder contains the labels of the corresponding images in the “image” folder and these labels are named as “AAAABBCCTDDEEFF_G_mask.png". Consequently, the frame number (“G”) and the frame label (3: None, 4: OnlySP, 5: OnlyHead or 6: SPHead) are, respectively, stored in the “frame_id” and “frame_label” columns of the file “frame_label.csv”. It is worth noting that the image in the “mask” folder may appear to be an all-black image due to the low label value (SP: pixel value of 7, Head: pixel value of 8, and the remaining pixel values of 0). The numbers of four types of images from each patient are listed in Table 1. There are 6224 images, including 1022 images with the None label, 323 images with the OnlySP label, 1136 images with the OnlyHead label and 3743 images with the SPHead label.

Schematic display generated by angle of progression (AoP) are shown in Fig. 1.

Examples (None, OnlySP, OnlyHead and SPHead) of the original (“Image”) and label (“Mask”) images are shown in Fig. 2. The pixel values corresponding to SP and Head are enhanced (“Enhanced mask”) here to be close to the style marked with Pair software, to facilitate the reader’s understanding of the dataset.

2. Experimental Design, Materials and Methods

A total of 78 videos from 51 pregnant women were collected from NanFang Hospital of Southern Medical University between 2019 and early 2020. This study was approved by the Medical Ethics Committee of NanFang Hospital of Southern Medical University (NFCE-2019–024). All authors confirm that we have complied with all relevant ethical regulations.

Transperineal ultrasound examinations were performed in standard B-mode ultrasound using the Youkey D8 wireless 2D ultrasound probe with its corresponding supporting software (Wuhan Youkey Bio-Medical Electronics Co., Ltd., Wuhan, China), which has a 3.53± 0.0525 MHz convex probe installed. The spatial resolution of the ultrasound system is specified by the manufacturer to less than 2 mm. The overall geometric inaccuracy of a very similar setup due to inherent technical limitations was measured to be <2.0 mm laterally, <2.0 mm vertically, <2.0 mm longitudinally, and <8.0 mm radially ('vector length' or Euclidean ‘3D-distance’; the square root of the sum of squares of the three axes) consisting of random errors (per single measurement point) and systematic errors (effectively, per fraction). The temporal resolution of the device is specified to about 27 Hz.

In order to obtain high-quality images, the transducer was prepped by covering it with a surgical latex glove filled with coupling gel, then the prepped transducer, after applying gel, was placed between labia below the pubic symphysis to obtain a sagittal plane, small adjustments in the form of lateral movements of the probe were made until an image obtained showed
| Patient | None | OnlyHead | OnlySP | SPHead | Files               |
|---------|------|----------|--------|--------|--------------------|
| 1       | 11   | 0        | 96     | 0      | 20190830T115515    |
|         |      |          |        |        | 20190830T115602    |
|         |      |          |        |        | 20190830T115644    |
| 2       | 0    | 0        | 9      | 0      | 20190904T101559    |
| 3       | 51   | 0        | 67     | 8      | 20190906T105145    |
|         |      |          |        |        | 20190906T105237    |
| 4       | 17   | 2        | 13     | 41     | 20190909T155747    |
| 5       | 26   | 10       | 3      | 106    | 20190909T161453    |
|         |      |          |        |        | 20190909T161601    |
| 6       | 42   | 0        | 40     | 26     | 20190911T104437    |
|         |      |          |        |        | 20190911T105058    |
| 7       | 0    | 0        | 53     | 0      | 20190911T111121    |
| 8       | 42   | 11       | 26     | 31     | 20190916T104520    |
| 9       | 28   | 0        | 23     | 98     | 20190916T105526    |
|         |      |          |        |        | 20190916T105641    |
| 10      | 11   | 0        | 0      | 63     | 20190916T110257    |
| 11      | 0    | 0        | 0      | 30     | 20190916T112312    |
| 12      | 12   | 0        | 4      | 58     | 20190918T115054    |
| 13      | 11   | 0        | 108    | 75     | 20190918T120011    |
|         |      |          |        |        | 20190918T120628    |
|         |      |          |        |        | 20190918T120708    |
| 14      | 29   | 0        | 26     | 137    | 20190918T123342    |
|         |      |          |        |        | 20190918T123437    |
| 15      | 123  | 0        | 92     | 0      | 20190922T101601    |
| 16      | 0    | 0        | 69     | 0      | 20190923T173644    |
| 17      | 4    | 0        | 68     | 0      | 20190923T175155    |
| 18      | 16   | 10       | 0      | 50     | 20190930T110010    |
| 19      | 4    | 2        | 0      | 66     | 20191003T173034    |
| 20      | 2    | 0        | 1      | 70     | 20191008T112326    |
| 21      | 0    | 0        | 0      | 127    | 20191008T114159    |
|         |      |          |        |        | 20191008T114249    |
| 22      | 11   | 0        | 2      | 62     | 20191026T195815    |
| 23      | 4    | 0        | 0      | 75     | 20191108T114950    |
| 24      | 2    | 0        | 0      | 145    | 20191115T105623    |
|         |      |          |        |        | 20191115T105730    |
| 25      | 2    | 0        | 65     | 7      | 20191115T110256    |
| 26      | 3    | 7        | 0      | 65     | 20191115T112474    |
| 27      | 8    | 0        | 64     | 1      | 20191115T114514    |
| 28      | 11   | 14       | 0      | 121    | 20191127T110323    |
|         |      |          |        |        | 20191127T110427    |
| 29      | 5    | 69       | 0      | 0      | 20191127T111516    |
| 30      | 0    | 2        | 0      | 119    | 20191127T112700    |
|         |      |          |        |        | 20191127T112757    |
| 31      | 14   | 1        | 0      | 132    | 20191127T113658    |
|         |      |          |        |        | 20191127T113821    |
| 32      | 18   | 17       | 9      | 106    | 20191129T103133    |
|         |      |          |        |        | 20191129T103822    |
| 33      | 0    | 5        | 0      | 70     | 20191129T105514    |
| 34      | 17   | 8        | 11     | 118    | 20191129T110558    |
|         |      |          |        |        | 20191129T110732    |
| 35      | 26   | 8        | 14     | 24     | 20191203T105250    |
| 36      | 13   | 0        | 0      | 131    | 20191203T11627    |
|         |      |          |        |        | 20191203T11732    |

(continued on next page)
clear maternal pelvic (pubic symphysis) and fetal (fetal skull) landmarks that did not show any shadows from the pubic rami [1–9]. Videos were in the MP4 format, with a resolution of 1920 × 1080. 6224 images are extracted from videos in 10 frames each. The mp4 is lossy compression or noise present in the mp4. However, we cannot remove noise because we export the data using the software that comes with the ultrasound instrument. It is worth noting that the image in the folder “image” has been preprocessed basically, and the original interface toolbar and text information of the image have been removed through cutting and overwriting operations. After processing, the resolution is 1295 × 1026. In order to prevent information loss, no downsampling is conducted. At the same time, it has been converted into a grayscale image, which can be read directly.

Ground truth is performed to make the ultrasound dataset beneficial. The software Pair (Shenzhen Duying Medical Technology Co., Ltd., Shenzhen, China) is used to perform this step. According to suggestions of radiologists, the following points in the image annotation were abided: (1) In an ideal situation, the SP and fetal head are elliptical in the two-dimensional image; (2) In grayscale ultrasound images, the outer borders of the SP and fetal head mainly appear bright white. When there is no obvious white border, the boundary is determined according to the difference of the local gray value; and (3) The lower right corner of the pubic symphysis is adjacent to the bladder, and the boundary of the pubic symphysis should be determined with the bottom edge of the white area [1,5–13]. Following these points, all the segmentation labels were independently created with the software Pair by five students and visually reviewed independently by two radiologists to ensure accuracy. An example of mask images is shown in Fig. 3. Each was firstly loaded in the Pair software (Fig. 3A), images were then selected from videos in 10 frames each (Fig. 3B) and regions of the SP (Fig. 3C) and fetal head (Fig. 3D) were finally labeled.

Pair software directly generates “.tar” files, and after decompression, “.json” and “.nii” files are generated. The “.json” file records the coordinates of the key points on the contour, and the “.nii” records the mask corresponding to the contour, whose value is the category id value set in the configuration file. Further, we set the SP pixel value in the mask to 7, and the pixel

| Patient | None | OnlyHead | OnlySP | SPHead | Files |
|---------|------|----------|--------|--------|-------|
| 37      | 16   | 0        | 95     | 39     | 20191205T103749 |
| 38      | 16   | 4        | 0      | 134    | 20191205T103904 |
| 39      | 16   | 19       | 18     | 24     | 20191208T165241 |
| 40      | 26   | 0        | 0      | 49     | 20191212T102143 |
| 41      | 23   | 0        | 7      | 118    | 20191212T103310 |
| 42      | 26   | 0        | 39     | 11     | 20191214T100241 |
| 43      | 25   | 0        | 3      | 46     | 20191214T103803 |
| 44      | 7    | 22       | 47     | 59     | 20191218T104745 |
| 45      | 15   | 44       | 3      | 160    | 20191218T105735 |
| 46      | 66   | 0        | 6      | 0      | 20191218T110113 |
| 47      | 74   | 0        | 1      | 0      | 20191220T104055 |
| 48      | 43   | 0        | 46     | 33     | 20191222T112127 |
| 49      | 30   | 2        | 5      | 115    | 20191222T113126 |
| 50      | 58   | 34       | 3      | 696    | 20200103T102728 |
| 51      | 18   | 32       | 0      | 97     | 20200103T105033 |

Table 1 (continued)
Fig. 1. Transperineal ultrasound to measure the angle of progression (AoP) formed between a straight line drawn along the longitudinal axis of the symphysis pubis (SP) and a line running from the inferior edge of SP to the leading edge of the fetal head. (A) Schematic diagram of calculating AoP; (B) An image with symphysis pubis and fetal head; (C) The segmentation result of the symphysis pubis (red) and fetal head (green); (D) Calculate AoP by elliptic function fitting.

value of the Head to 8 to generate each label. Read the classification of different labels through "FrameLabel" in the "*.json" file (3: None, 4: OnlySP, 5: OnlyHead or 6: SPHead). Finally, we convert the grayscale image to an RGB image (SP is red, Head is green). For the configuration parameters of the Pair software and the label reading code, we will provide the corresponding configuration files and codes in https://github.com/JNU-IFM/JNU-IFM-config-and-code.git.
Fig. 2. Examples (None, OnlySP, OnlyHead and SPHead) of the original (“Image”), label (“Mask”) and enhanced label (“Enhanced mask”) images.

Fig. 3. An example to help illustrate the label acquisition process using the Pair software. (A) Videos were loaded in the Pair software; (B) An image from a video was selected to label regions of the symphysis pubis and fetal head; (C) The symphysis pubis was labeled with red; (D) The fetal head was labeled with green.
Ethics Statements

This study was approved by the Medical Ethics Committee of NanFang Hospital of Southern Medical University (NFCE-2019–024).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT Author Statement

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Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2022.107904.

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