

# Neonatal 3D face reconstruction using frontal, left, and right profile 2D photographs

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## Motivation & Goals

- This work is part of a longitudinal study that analyzes the fetal development of the face from 20 weeks of gestation to the neonatal stage of 30 days of life for the detection of craniofacial anomalies.
- Particularly, this abstract tackles the reconstruction of the 3D facial shape of the newborn from multiple 2D images (frontal, left, and right profile) using a new deep learning network architecture

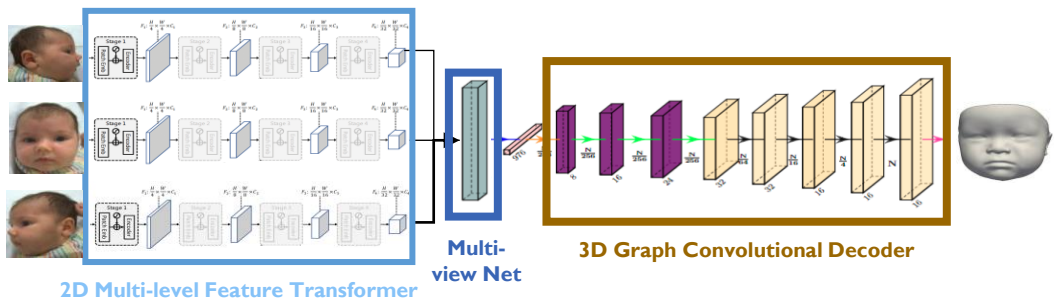
## Data

- 11 healthy newborns were visited by a neonatologist around 15 and 30 days after birth. Distances between homologous landmarks were measured, as well as height and weight, and 3 facial photographs were taken (frontal, left, and right profile).



## Methodology

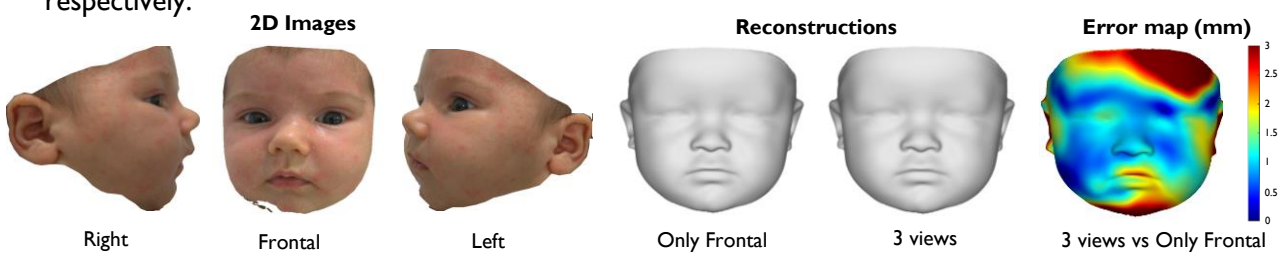
- 3D Reconstruction:** We propose a new deep learning network architecture to reconstruct the facial shape that takes as input three 2D images. The network is composed of 3 blocks: a 2D transformer encoder, a multiple view integrator, and a 3D decoder.



- Validation Metrics:** The distances between homologous landmarks in the obtained 3D reconstructions are calculated. Then, the Euclidean error between the measurements done by the neonatologist and those obtained from the reconstruction are computed.

## Results

- The proposed network obtains a mean error of  $3.4 \pm 2.6$  mm in the distance measurements at 15 days of age when using the three profiles images to reconstruct the 3D face. Whereas, when using only the frontal image to reconstruct the face, the mean error is  $4.9 \pm 7.6$  mm. The same procedure was repeated using the images captured at 30 days of age, obtaining errors of  $3.3 \pm 2.4$  and  $3.9 \pm 4.0$  mm, respectively.



## Conclusions

- Preliminary reconstructions show a low reconstruction error and good visual agreement between the real and the reconstructed facial shape. It can be appreciated that using 3 images improves the accuracy and quality of the obtained 3D reconstructions, particularly the depth (anterior-posterior axis) and the mouth region. Also, we have noticed that 15 days reconstructions are harder for our method as the training data contain few cases in that range and with closed eyes. As future work we intend to compare prenatal and postnatal 3D reconstructions to evaluate their quality and find if there is a relation between both reconstructions.

## Acknowledgments

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