Deep Learning for the Automatic Classification of Congenital Lung Abnormalities Using MRI Scans

Background
- Congenital lung abnormalities are rare diseases that occur during pregnancy.
- Diagnosis of congenital lung abnormalities from MRI images allows physicians to:
  - Improve clinical management during or after delivery.
  - Provide information on the outcome of the pregnancy.
- Currently, there are no fast and fully automatic classification models.
- We explore the application of Convolutional Networks with 2D and 3D kernels to fetal MRI scans to automatically diagnose abnormal fetal lungs.

Goal
- Development of fast and fully automatic classification models saves physician time and provides an entry point to more complex models of lung volumetry that further improve diagnostic accuracy.

Data
- 4632 Single Shot Fast Spin Echo (SSFSE) T2-weighted Fetal MRI Scans in multiple orientations.
- Ground-truth from radiologists with 12 yrs experience.
- Collected from 2004-2017 at Stanford Hospital.
- Each scan is comprised of a series of 2 dimensional grayscale values.

Methods and Models
- 2D CNN Architecture
- ResNet
- DenseNet
- 3D ResNet-18
  - 3 x 3 x 3 convolutional layers
  - Batch-norm (BN) and ReLU
  - Two convolutional layers
  - 3 x 3 x 3
  - Squeeze and Excitation (SE) block
  - Global average pooling
- 3D ResNet Block
- Identity connections to avoid increasing number of parameters.

Results
- Table 1: Classification Performance for three models on Fetal MRI data set.

References