Machine Learning (XAI501) Term Project Bi-weekly report

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Bayesian Uncertainty Estimation for Ultrasound Medical Image Segmentation

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**Milestones**

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| Date | Milestones | Remark |
| 10/28 (Wed) | Proposal | Done |
| 11/04 (Wed) | Data preprocessing and understanding | Done |
| 11/11 (Wed) | Proposed architecture design and implementation | Done |
| 11/18 (Wed) | Experiments conducting (1) | Proceeding |
| 11/25 (Wed) | Experiments conducting (2) | Proceeding |
| 12/02 (Wed) | Analysis |  |
| 12/09 (Wed) | Final documentation and presentation preparation |  |
| 12/13 (Sun) | Final documentation and presentation preparation |  |

**Group progress**

* Paper research
* Reference finding
* Experiment conducting

**Individual progress**

* Sangjin : Search for references related to the bayesian model for semantic segmentation
* Jinhyo : Find papers on techniques dealing with these issues for precise inference
* Sunwoo : Experimental progression to naturally combine the bayesian method with segmentation
* Kwanseok : Finding an evaluation method to estimate the uncertainty possessed by the output of the bayesian model

**New findings**

* Paper research & Reference finding
  + We analyzed related papers that perform approximate Bayesian inference in deep neural networks and that can estimate uncertainty in addition to prediction:
    - Weight uncertainty in neural network
      * arXiv 2017
      * Link : <https://arxiv.org/pdf/1505.05424.pdf>
    - Deep gaussian processes for regression using approximate expectation propagation
      * ICML 2016
      * Link: <http://proceedings.mlr.press/v48/bui16.pdf>
  + We found two dropout based approximate inference techniques which seems useful to create probabilistic versions of segmentation model :
    - Dropout as a bayesian approximation: Representing model uncertainty in deep learning
      * ICML 2016
      * <http://proceedings.mlr.press/v48/gal16.pdf>
      * This paper is about MC dropout.
    - Concrete dropout
      * NIPS 2017
      * <https://proceedings.neurips.cc/paper/2017/file/84ddfb34126fc3a48ee38d7044e87276-Paper.pdf>
* Experiment conducting
  + We are currently solving this issue because it is difficult to proceed with model training.
    - Since the segmentation map is not generated, the number of layers in the feature extractor is being adjusted.
    - In addition, since it does not seem to take advantage of the dilation convolution used in DeepLab-v3, we are devising a way to maximize spatial information by changing the receptive field size of each kernel.
    - The results were also not judged to be meaningful, so we did not mention them separately.