COSC 525: Deep Learning

Final Project Proposal

Title of the project:

Improving Deep Learning Mammogram Classification via GAN.

Team:

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Problem Definition:

Breast cancer is the most common form of cancer for women according to Shi *et al.*, 2019 or National Cancer Insitute, 2020. Therefore, the detection of breast cancer at an early stage using mammography images is imperative to reduce the number of fatal cases. Deep learning architectures have shown to be a valuable method in classifying malignant and benign breast cancer cases.

Most datasets of mammography images are small and thus provide a significant problem in training deep learning networks. This work aims to increase the number of images by using GAN and data augmentation methods.

Motivation:

We hope to improve the performance of existing deep learning classifiers by generating more images via the use of GAN. Increasing the performance of classifiers will help the field of radiology to detect breast cancer and help patients.

Literature review:

Literature review will include the following main papers:

Alyafi, B., Diaz, O. and Marti, R. (2019) 'DCGANs for Realistic Breast Mass Augmentation in X-ray Mammography'. Available at: http://arxiv.org/abs/1909.02062.

Gardezi, S. J. S. *et al.* (2017) 'Mammogram classification using deep learning features', *Proceedings of the 2017 IEEE International Conference on Signal and Image Processing Applications, ICSIPA 2017*, pp. 485–488. doi: 10.1109/ICSIPA.2017.8120660.

Ismail, N. S. and Sovuthy, C. (2019) 'Breast Cancer Detection Based on Deep Learning Technique', *2019*

International UNIMAS STEM 12th Engineering Conference, EnCon 2019 - Proceedings, pp. 89–92. doi: 10.1109/EnCon.2019.8861256.

Kaur, Prabhpreet, Singh, G. and Kaur, Parminder (2019) 'Erratum: Intellectual detection and validation of automated mammogram breast cancer images by multi-class SVM using deep learning classification (Informatics in Medicine Unlocked (2019) 16, (S2352914818301813), (10.1016/j.imu.2019.01.001))', *Informatics in Medicine Unlocked*. Elsevier Ltd, 16(August), p. 100239. doi: 10.1016/j.imu.2019.100239.

Shi, P. *et al.* (2019) 'Deep learning from small dataset for bi-rads density classification of mammography images', *Proceedings - 10th International Conference on Information Technology in Medicine and Education, ITME 2019*, (c), pp. 102–109. doi: 10.1109/ITME.2019.00034.

Dataset:

mini-MIAS dataset (http://peipa.essex.ac.uk/info/mias.html) / mammogram database (https://www.mammoimage.org/databases/

The dataset includes 322 grey-scaled images of mammograms for pairs of breasts and labels.

Proposed method:

We plan to use GAN to perform sample generation and use existing deep learning architectures (e.g., VGG16, ResNet50) from the literature to compare their performance.

Evaluation:

We will compare our results with existing results from literature. Possible metrics could be precision, recall, or accuracy. Plots may as well be created for comparison.