Bachelor Thesis - Report 2

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Bibliographical Documentation

1. Alsubaie, M.G.; Luo, S.; Shaukat, K. Alzheimer's Disease Detection Using Deep Learning on Neuroimaging: A Systematic Review. Mach. Learn. Knowl. Extr. 2024, 6, 464-505. https://doi.org/10.3390/make6010024

   - This paper gives detailed explanations on notions from medicine used in this study, the state-of-the-arts approaches to Alzheimer's Disease Detection, the datasets and the multi-modal input methods
   - Highly valuable research paper, giving important initial directions in the chosen topic
   - Its place is to make an overhaul on the 2018-2023 improvements in AD detection

2. Matthews PM, Jezzard P. Functional magnetic resonance imaging. J Neurol Neurosurg Psychiatry. 2004 Jan;75(1):6-12. PMID: 14707297; PMCID: PMC1757457. https://pubmed.ncbi.nlm.nih.gov/14707297/

   - Matthews and Jezzard explain one of the most commonly used types of fMRI, the blood oxygenation level dependent (BOLD) functional MRI, and the advantages it brings versus Electroencephalography (EEG) scans
   - Less useful paper, nevertheless I considered it important to grasp the way MRI data is gathered for a better understanding of the problem.
   - Helped understanding the importance of relaxation times of the brain T_1, T_2, T_2^*

3. Gorgolewski KJ, Auer T, Calhoun VD, Craddock RC, Das S, Duff EP, Flandin G, Ghosh SS, Glatard T, Halchenko YO, Handwerker DA, Hanke M, Keator D, Li X, Michael Z, Maumet C, Nichols BN, Nichols TE, Pellman J, Poline JB, Rokem A, Schaefer G, Sochat V, Triplett W, Turner JA, Varoquaux G, Poldrack RA. The brain imaging data structure, a format for organizing and describing outputs of neuroimaging experiments. Sci Data. 2016 Jun 21; 3:160044. doi: 10.1038/sdata.2016.44. PMID: 27326542; PMCID: PMC4978148.
   https://pubmed.ncbi.nlm.nih.gov/27326542/

   - Paper sheds light on the importance of a standardization of how data regarding neuroimaging is stored, specifying the previous standards,

among which some weren't adopted (XML) and some got selected forward (JSON, NIfTi, tsv)

- Relatively important due to the need of understanding how datasets work in other scientific fields for an easier time utilizing them

- This paper stands at a base level in the economy of the research, laying out the foundations which data gatherers abide to

4. Jack CR Jr, Bernstein MA, Fox NC, Thompson P, Alexander G, Harvey D, Borowski B, Britson PJ, L Whitwell J, Ward C, Dale AM, Felmlee JP, Gunter JL, Hill DL, Killiany R, Schuff N, Fox-Bosetti S, Lin C, Studholme C, DeCarli CS, Krueger G, Ward HA, Metzger GJ, Scott KT, Mallozzi R, Blezek D, Levy J, Debbins JP, Fleisher AS, Albert M, Green R, Bartzokis G, Glover G, Mugler J, Weiner MW. The Alzheimer's Disease Neuroimaging Initiative (ADNI): MRI methods. J Magn Reson Imaging. 2008 Apr;27(4):685-91. doi: 10.1002/jmri.21049. PMID: 18302232; PMCID: PMC2544629. https://doi.org/10.1002/jmri.21049

- Article describes the methods of how the ADNI dataset was created, which type of scans were given more attention to, emphasizing the importance of maximizing scientific value while minimizing patient burden.

- I had received permission to use this dataset, but had found many notations given without explanation. Having read through this paper many of the questions were answered, thus I consider this paper of high importance.

- It is yet another fundamental article in the topic of research, describing the scanning process and offering to the scientific public a mass of data for researching Alzheimer's Disease

5. Klein A, Andersson J, Ardekani BA, Ashburner J, Avants B, Chiang MC, Christensen GE, Collins DL, Gee J, Hellier P, Song JH, Jenkinson M, Lepage C, Rueckert D, Thompson P, Vercauteren T, Woods RP, Mann JJ, Parsey RV. Evaluation of 14 nonlinear deformation algorithms applied to human brain MRI registration. Neuroimage. 2009 Jul 1;46(3):786-802. doi: 10.1016/j.neuroimage.2008.12.037. Epub 2009 Jan 13. PMID: 19195496; PMCID: PMC2747506.
https://pubmed.ncbi.nlm.nih.gov/19195496/

- This paper ranks algorithms used for one of the most important pre-processing steps, image registration, which represents the positioning of the brain scans of different patients in the same positions with respect to others, to lead to easier time handling the image collections

- The use this paper brings me is to understand data pre-processing steps from a different area of expertise

- But with that being said, its importance compared to other papers could be considered lower

6. Jenkinson M, Bannister P, Brady M, Smith S. Improved optimization for the robust and accurate linear registration and motion correction of

brain images. Neuroimage. 2002 Oct;17(2):825-41. doi: 10.1016/s1053-8119(02)91132-8. PMID: 12377157.
https://pubmed.ncbi.nlm.nih.gov/12377157/

- This publication describes a new approach to previous algorithms used in brain scans pre-processing, such as image registration and motion correction, which were shown to lead to a local minimum

- This new approach, simply put, expands the view at a step in the search algorithm, which, while increasing computation, can have the chance of escaping a local minimum. That being said, there is no guarantee in finding the global minimum, similarly to any global minimum algorithm without infinite time

- Main use to me was the explanation of another pre-processing step, motion correction, which represents solving movements of either the clinical patients or the scanner, due to the fact that the images are taking at intervals of time, and a certain correlation between consecutive scans must be kept

7. Tom Fawcett, An introduction to ROC analysis, Pattern Recognition Letters, Volume 27, Issue 8, 2006, Pages 861-874, ISSN 0167-8655, https://doi.org/10.1016/j.patrec.2005.10.010.

- This piece of research presents ROC graphs as an evaluation metric and their advantages over other commonly used metrics in classification problems, such as accuracy, sensitivity, specificty.

- I would consider this article moderately important, having noticed in diagnostic classification that this metric is particularly useful, in the way the trade-off between benefits and costs has agency over an algorithm in this topic (benefits - True Positives, costs - False Positives).

- The paper stands at an introductory level in the topic of research, given the fact it summarizes the importance of an evaluation metric, previously unused by me.

8. Bae JB, Lee S, Jung W, Park S, Kim W, Oh H, Han JW, Kim GE, Kim JS, Kim JH, Kim KW. Identification of Alzheimer's disease using a convolutional neural network model based on T1-weighted magnetic resonance imaging. Sci Rep. 2020 Dec 17;10(1):22252. doi: 10.1038/s41598-020-79243-9. PMID: 33335244; PMCID: PMC7746752.
https://pubmed.ncbi.nlm.nih.gov/33335244/

- This article summarizes a Deep Learning approach to the classification, opting for 2D image inputs and a binary classification between Cognitive Normal(CN) and Alzheimer's Disease(AD) utilizing a CNN-like architecture.

- Highly important article, underlines the importance of the datasets, specifically the demographic origin and education level, explaining that, for example, Caucasians with higher education level(from ADNI dataset) will have a different brain shape compared to Koreans or Japanese of lower or medium education level.

9. Minh Nguyen, Tong He, Lijun An, Daniel C. Alexander, Jiashi Feng, B.T. Thomas Yeo, Predicting Alzheimer's disease progression using deep recurrent neural networks,NeuroImage, Volume 222, 2020, 117203, ISSN 1053-8119, https://doi.org/10.1016/j.neuroimage.2020.117203.

   - Compared to paper 8, this article utilizes a different network architecture, an RNN, specifically a minimalRNN, its predecessor being an LSTM which had problems with overfitting. Switching over to an RNN, the problem had gotten fixed. Their goal was to predict at indefinite amount of time points in the future the presence of Alzheimer's Disease.

   - Another point this paper brings up is how missing data is treated, suggesting that it would be wiser not to ignore it, but to fill it up, and they end up describing 3 methods of doing so, leading to better experiment reults.

   - All in all, this article summarizes a contest awarded approach, specifically The Alzheimer's Disease Prediction Of Longitudinal Evolution(TADPOLE), where it had achieved 2nd place in 2020.

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