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School of Computer Science

Scientific Research & Literature

in Fulfilment of

SPEC9997

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Topic in data science

Topic: Examining cyclist behaviour in urban centres

Reference: Richardson, M. & Caulfield, B. (2015). Investigating traffic light violations by cyclists in Dublin City Centre. *Accident Analysis and Prevention, 84,* 65-73. doi: 10.1016/j.aap.2015.08.011

Aim: To examine red light running of cyclists in Dublin City.

Methods: An observational survey and an online questionnaire.

Conclusions: 61.9% of cyclists break the lights: 97.8% of cycle track users (pedestrian green phase); 18.6% of bicycle lane users (motorist phase). The most significant predictors were infrastructure type (cycle track) and cyclist gender (male).

Gaps in the Research: Need to account for difficulties people have in reporting incidents while cycling

Critique: The Dublin cycle network primarily consists of on-road cycle lanes. The surveys focussed on an even number of junctions with cycle lanes and cycle tracks. The overall rate of infringement is not fairly represented: in reality, it would be lower… (…)

# Paper 1

**Topic:** Pattern recognition of brain biomarkers for dissociative identity disorder

**Reference:** Reinders, A., Marquand, A. F., Schlumpf, Y. R., Chalavi, S., Vissia, E. M., Nijenhuis, E., Dazzan, P., Jäncke, L., & Veltman, D. J. (2019). Aiding the diagnosis of dissociative identity disorder: pattern recognition study of brain biomarkers. *The British journal of psychiatry : the journal of mental science*, *215*(3), 536–544. https://doi.org/10.1192/bjp.2018.255

**Aim:** To investigate whether pattern recognition can help identifying biomarkers for DID diagnosis.

**Methods:** Brain images/MRI were compared using probabilistic pattern classifiers. Survey for healthy patients were used for screening.

**Conclusions:** Classification model yielded an accuracy of 72.84%, found significant proof that individuals with D.I.D can be distinguished from healthy ones via spatially dependant patterns in white and grey brain matter. Patients with D.I.D can be identified at an accuracy of 71.88% through the studying of underlying effects. This can be considered a limitation or solution due to a lack of data.

**Gaps in the Research:** Due to limited data research can potentially be more rigid. Researchers suggested that a control group for PTSD would be advisable to see its effect not the classification, similar can be said about other comorbid symptoms.

**Critique:** It's early in the life span of this kind of research to tell, the paper acknowledges the inferences are made at a group level and a limited ability to provide insight at an individual level. It's used as a proof of concept that differences in biomarkers can be extracted to provide some use.

# Paper 2

**Topic:** Application and limitation of machine learning in predicting mental health diagnosis

**Reference:** Tiffin, P. A., & Paton, L. W. (2018). Rise of the machines? Machine learning approaches and mental health: opportunities and challenges. *The British Journal of Psychiatry*, *213*(3), 509–510. http://doi.org/10.1192/bjp.2018.105

**Aim:** Identifying strengths and weaknesses of machine learning in mental health

**Methods**: Content analysis

**Conclusions:** Risk of overfitting models to the data used, since in some conditions data is very limited. Machine learning uses “brute force” of ensemble models and lack of interpretability of deep learning techniques.

**Gaps in the Research:** Statements aren’t really explored in more detail such as pointing out issues that could come from streamlining an automated diagnosis system and how it would be implemented.

**Critique:** The author didn’t include/review many papers, it almost reads like an opinion piece, claiming that models can’t adapt to a potential change in the use of language when trained on scraped web data to detect depression or suicidal behavior is in my opinion not accurate, if such a change did occur then sensitivity analysis or outlier detection could be used to accommodate such an occurrence in the advent of a slang term being invented, it feels like a devil’s advocate argument. Another point is that in such cases one would not relay on one model but multiple preforming different functions such as looking for new slang and analyzing if it relates to existing topologies etc.

# Paper 3

**Topic:** Application of deep learning to mental health, a scoping review

**Reference:** Su, C., Xu, Z., Pathak, J., & Wang, F. (2020). Deep learning in mental health outcome research: a scoping review. *Translational psychiatry*, *10*(1), 116. https://doi.org/10.1038/s41398-020-0780-3

**Aim:** Review existing research on the application of deep learning techniques to mental health problems.

**Methods:** Thematic analysis, Content analysis, Meta-analysis, Systematic review

**Conclusions:** Deep Learning is gaining more traction in healthcare despite not being as interpretable as statistical or white box models, although its still not as popular as the latter. In accompanying tables, you can see the findings of all papers in which deep learning was used. This is a very short conclusion as there are many papers compared in accompanying tables.

**Gaps in the Research:** As this paper evaluated the state of the art its difficult to address potential gapswithout having significant knowledge/experience in the area. One thing worth mentioning is that it seems like their process for collecting said papers could have been a better rather than what it felt like “randomly” searching for papers.

**Critique:** A more advanced audience/reader would find some of the material too elementary, it was a good mix for someone like myself starting research in the area. I didn’t find anything worth critiquing as this paper was reviewing use cases, I’ve covered it to gain insight on state-of-the-art application of machine learning in mental health.

# Paper 4

**Topic:** Classifying and predicting the onset of mental health disorders using functional connectivity

**Reference:** Yuhui Du1, Z. F. (06 August 2018). Classification and Prediction of Brain Disorders Using Functional Connectivity: Promising but Challenging. frontiers in Neuroscience.

**Aim:** Compare and review state-of-the-art of functional connectivity analysis methods, static vs dynamic connectivity.

**Methods:** Thematic analysis, Content analysis, Meta-analysis, Systematic review

**Conclusions:**

**Gaps in the Research:**

**Critique:**

# Paper 5

**Topic:**

**Reference:**

**Aim:**

**Methods:**

**Conclusions:**

**Gaps in the Research:**

**Critique:**

# References

Chang Su, Z. X. (2020). Deep learning in mental health outcome research: a scoping review. *Translational Psychiatry*, 10(1), 116. https://doi.org/10.1038/s41398-020-0780-3.

Paul A. Tiffin, L. W. (2018). Rise of the machines? Machine learning approaches and mental health: opportunities and challenges. *The British Journal of Psychology* , 213, 509–510. http://doi.org/10.1192/bjp.2018.105.

Reinders, A. M. (2019). Aiding the diagnosis of dissociative identity disorder: pattern recognition study of brain biomarkers. *The British journal of psychiatry* , 215(3), 536–544. https://doi.org/10.1192/bjp.2018.255.

Yuhui Du1, Z. F. (06 August 2018). Classification and Prediction of Brain Disorders Using Functional Connectivity: Promising but Challenging. *frontiers in Neuroscience*.