Deep Learning Approaches for Genetic Based Cancer Healthcare Modelling, for use in Economic Evaluations

supervised by

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Advances in computational power, genomics, and imaging, has resulted in vast amounts of genetic profiling data. Machine learning techniques such as deep learning can be used to harvest further information to aid prediction of diseases [1].

Health Technology Assessment (HTA) agencies receive information in the form of an economic evaluation including clinical trial evidence and a cost-effectiveness model to compare the costs and benefits of a new drug compared to the standard of care. Each new drug is assessed according to it's individual license - usually one therapeutic area/tumour type at a time. Cost-effectiveness models often contain a Markov component that is used to describe the survival time of individuals. A Markov model can be used to describe the process where the risk of an event is continuous over time and the event can happen multiple times [2]. Markov models are useful in healthcare for modelling the progression of a disease of an individual and have been increasingly used within cost-effectiveness models partly due to recent advances in computing which permits higher processing capacities.

As precision medicine is an approach for disease treatment and prevention that takes into account individual variability in genes, environment, and lifestyle for each person [3], new deep learning approaches could be used to aid the building of the Markov component of a cost-effectiveness model if genomics surrounding a particular disease can be linked to response to medications. This would allow a more accurate prediciton of treatment and outcomes for a particular disease or tumour type.

Quantitative training such as mathematics or statistics is required for this project. An interest in the area of Economic Evaluations, Data Analytics, genetics, or experience of any will be considered an advantage.

References

[1] Angermueller C, Pärnamaa T, Parts L, Stegle O, *Deep learning for computational biology* Molecular systems biology, Jul 2016.

[2] Sonnenberg, Beck, *Markov models in medical decision making: a practical guide*, Medical decision making, Dec 1993.

[3] Love-Koh J, Peel A, Rejon-Parrilla JC, Ennis K, Lovett R, Manca A, Chalkidou A, Wood H, Taylor M, *The future of precision medicine: potential impacts for health technology assessment* Pharmacoeconomics, Dec 2018.