

Machine Learning for Neuroscience

Slides and notebooks: <https://github.com/PBarnaghi/ML4NS>

Notes by: *Nan Fletcher-Lloyd, Payam Barnaghi*

Lecture 8. Applications of Machine Learning in Neuroscience

In lecture 8, we cover some of the real-world applications of machine learning in neuroscience. We also discuss how concepts from neuroscience have been applied to machine learning.

In this lecture, we discuss how neuroscience can provide inspiration for new types of algorithms and architectures. We first review the content of previous lectures, before expanding further on different sub-fields of machine learning. These include reinforcement learning, deep learning, attention-based learning, and continual learning, citing state-of-the-art works for each.

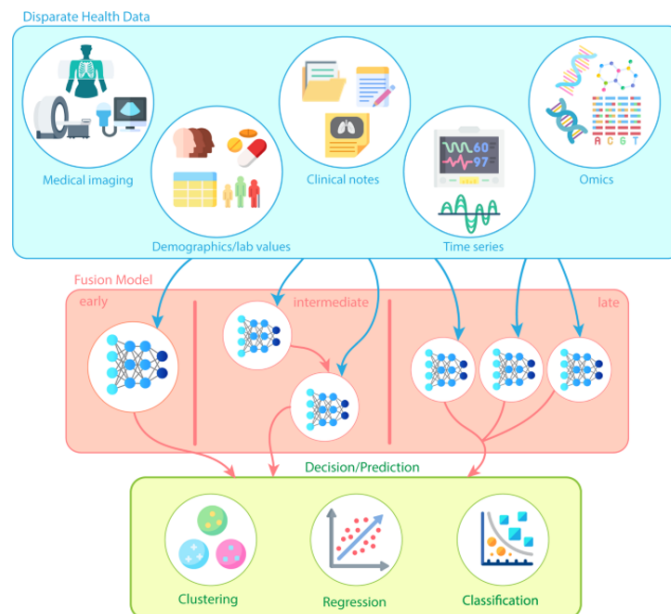


Figure 8.1. Applications of machine learning at different stages of disease

Source: Kline, A., Wang, H., Li, Y. *et al.* Multimodal machine learning in precision health: A scoping review. *npj Digit. Med.* 5, 171 (2022).

<https://doi.org/10.1038/s41746-022-00712-8>

We also consider the applications of machine learning in precision health care, from neuroimaging to electronic healthcare record analysis to diagnosis and treatment of diseases to predicting the progression of disease. Figure 8.1 illustrates how machine learning can be applied in health-care at different stages of a disease.

Finally, we discuss the practical methodology of machine learning approaches, in terms of dimensionality reduction of a dataset and imputation of missing values in a dataset.

The corresponding assessment will help you to evaluate your understanding of the potential real-world applications of machine learning.

For this assessment, we ask you to write a report (1000-words maximum) on the advantages and limitations of using machine learning methods to solve real-world problems, as well as a discussion on the ethical challenges posed by such approaches.