Summary post: Self-supervised learning – general concepts and applications within medicine

Self-supervised learning (SSL) is a subset of machine learning (ML) where informative features in unlabelled data are inferred by generating and learning to predict “pretext” labels derived from the data itself (Krishnan, Rajpurkar and Topol, 2022). This foregoes the need for large labelled datasets, and is particularly useful in medicine, where specialist labelling can be prohibitively expensive.

Jaafar suggests that semi-supervised learning is also valuable when availability of labelled data is limited. While this is correct, self-supervised and SSL are inherently different, as SSL models use underlying features within the data itself, whereas semi-supervised learning still requires labelled inputs. Importantly, he added that generative learning may be used not only for classification but also for text and image generation tasks (namely with the use of generative adversarial networks).

Rodrigo mentioned masked modelling as a potentially useful approach for application of self-supervised learning to deep learning models, similarly to the generative learning approach discussed (Krishnan, Rajpurkar and Topol, 2022).

Martyna highligted that SSL models may be costly to develop and maintain. However, increasing computing capacity is likely to be more cost-efficient than the huge increments in human specialist time needed to generate large labelled datasets in medicine. She also cautions about using SSL versus supervised learning due to lack of transparency/interpretability. While interpretability is certainly important, I note that not all supervised learning models are interpretable, neither the opposite is true for all SSL models.

Finally, Natali mentions potential issues with negative sampling bias in anomaly detection. While this is indeed important, it should be noted that SSL models outperform all other approaches in this domain, and that more recent models can account for this issue (Hojjati, Ho and Armanfard, 2024).

In summary, SSL is a promising approach for developing ML models when labelled data is scarce, such as in medicine, while also valuable for generative tasks. As with any ML paradigm, limitations around interpretability and model bias should be acknowledged and addressed, particularly in a sensitive field such as healthcare.

**References**:

Hojjati, H., Ho, T.K.K. and Armanfard, N. (2024) ‘Self-supervised anomaly detection in computer vision and beyond: A survey and outlook’, *Neural Networks*, 172, p. 106106. Available from: https://doi.org/10.1016/j.neunet.2024.106106.

Krishnan, R., Rajpurkar, P. and Topol, E.J. (2022) ‘Self-supervised learning in medicine and healthcare’, *Nature Biomedical Engineering*, 6(12), pp. 1346–1352. Available from: https://doi.org/10.1038/s41551-022-00914-1.