GENIE-MRI: Generative Neural Networks for Image Exchange in breast MRI

Breast cancer is one of the most common cancers affecting women worldwide. For this reason, its early detection is a significant challenge for today's health systems. Breast magnetic resonance imaging (MRI) offers a highly detailed view of breast tissue and is particularly important for the approximately 40% of women with dense glandular breast tissue. Artificial intelligence (AI) algorithms have great potential to improve and expand the use of breast MRI by reducing its cost and measurement time. However, progress in developing new AI methods for MRI needs remains relatively slow. This is mainly due to the lack of large, publicly available databases of breast MRI measurements. Furthermore, stringent medical data privacy laws restrict data sharing, making it difficult for researchers to train and test new AI algorithms that could improve diagnosis and treatment.

To address these challenges, the GENIE-MRI project will investigate how artificial intelligence, in particular generative neural networks, can produce realistic ‘synthetic’ breast MRI images. These images are intended to mimic the basic features needed for the study, without revealing any information that could identify the patient. By creating a wide range of synthetic data, the project aims to support the development of new AI algorithms for breast cancer diagnosis, improving their reliability and ensuring that they work well for different patient populations.

GENIE-MRI will investigate several important questions: How well can AI algorithms learn to generate synthetic breast MRI images that look and ‘feel’ like the real thing? Can original patient data ever be reconstructed from these synthetic images? And can AI models trained on solely synthetic data produce results with a performance similar to models trained on real patient scans?

If successful, the GENIE-MRI project could spark a wave of innovation, not only in breast cancer diagnosis, but also in other areas of medical imaging. In the long term, it could help improve data sharing, simplify international collaboration and accelerate the development of life-saving diagnostic tools - ultimately improving patient outcomes and contributing to more personalised, effective cancer care.