Project Title: Intelligent Automated Interpretation and Reporting of Medical Images

Project Description:

Over the last decade, the quantity of digital medical imaging data held by hospitals and other healthcare establishments has increased dramatically. Medical images are full of implicit information and conceptual insights and are a key component of healthcare screening, diagnosis and treatment. Currently, highly trained medical experts identify clinically relevant information from a wide range of medical images. Image interpretation is often context-dependent, time-consuming, and subjective, resulting in potential inconsistencies in the identification of pathology and misinterpretation of reports by other clinical colleagues.

The development of Artificial Intelligence and Machine Learning methods for automatically extracting and learning clinically relevant features contained in medical images is receiving increasing attention. It also provides an unprecedented opportunity to accelerate clinical workflows and improve patient care [1-3]. Automated interpretation of medical images has potential to significantly speed up the reporting of medical imaging data, to improve the quality and consistency of reporting, and to act as a second opinion for medical diagnosis. In addition to numerous novel clinical applications, machine learning could aid the identification of new imaging biomarkers for medical research and education. However, feature learning from medical imaging data, supported by machine learning, is only one aspect of clinical reporting. Contextualisation of this information and incorporation into clinical pathways will be key to avoiding bottlenecks in translation to the National Health Service (NHS), ensuring meaningful interpretation of images that maximise the impact of digital technologies, and provide relevant clinical information to staff and patients. These 'smart reporting' methods can be achieved through development of algorithms in partnership with NHS staff to embed machine learning support into referral procedures appropriate to the clinical context of the imaging. This PhD is unique in having a focus on translation of machine learning to clinical practice, and development of frameworks for 'smart reporting' of medical images capable of articulating complex conceptual information to medical staff and patients.

This PhD project aims to improve reporting of a range of medical conditions by developing machine-learning approaches, especially deep learning, for automated image interpretation. The student will apply AI to data available through ImageCLEF 2019 (https://www.imageclef.org/2019/medical/caption) to automatically extract clinically valuable textual information for 'smart reporting' of medical images and to provide a lay summary of imaging results suited to the patient's understanding.

References:
[1] Ionesco *et al.,* Overview of ImageCLEF 2017: Information Extraction from Images, 2017
[2] Eickhoff *et al*., Image caption prediction and concept detection for biomedical images, 2017,
[3] Riegler *et al*. , Multimedia and Medicine: Teammate for better disease detection and survival, 2016

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