***"FloraFrames: Charting AI Routes from Plants to Patients"***

Grant Proposal

**Background**

Artificial Intelligence (AI) is revolutionising healthcare, as emphasised by recent research (Younis et al., 2024). The topic is critical because AI has the potential to significantly improve the accuracy of disease diagnosis and the efficiency of treatment planning (Younis et al., 2024). However, a major gap persists in the form of a severe shortage of diverse, high-quality training datasets, which is necessary for developing robust AI diagnostic systems. This shortage is further compounded by a lack of medical image data for rare diseases and the ethical complexities surrounding the use of personal health data (Olveres, 2021; Tibbets, 2018).

Our project aims to address this gap by leveraging the extensive diversity of plant life at Kew Gardens, a site with a rich variety of species (UNESCO World Heritage Centre, n.d.), to create a novel dataset that can inform the AI training process. By using plant morphology as a stand-in for human anatomical structures, we can generate a broad spectrum of data that enhances the AI's ability to learn and recognise patterns, potentially translating into more accurate medical imaging analysis. This approach not only promises to enrich the AI model with a new kind of dataset but also circumvents the ethical and privacy issues typically associated with human medical data (Price and Cohen, 2019).

A screenshot of a computer

Description automatically generated

Figure 1: A spectrum of market concentration in AI Medical Imaging (Mordor Intelligence)

This strategy may also position FloraFrames as a new entrant in the AI in medical imaging market, which is projected to grow twenty fold over the next decade in the United States (Grand View Research, 2023). Despite the trend towards market consolidation as indicated in Figure 1, our unique data acquisition method positions us to potentially overcome the barriers to entry and contribute meaningfully to the advancement of medical imaging AI.

**Research Plan**

We intend to develop, within R studio, an AI system that uses computer vision to support diagnosis, but we will use plant identification to support the machine learning process. The process will rely on transfer learning, where the system learns to identify patterns from libraries of labelled data for one task and uses this as a foundation for performing a different task, repurposing the model (Sharma and Parikh, 2022). The training from a larger dataset provides the core pretraining for another dataset, reducing the amount of images and labelling needed (Fig. 2).

A diagram of training and training

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Figure 2: Transfer Learning Schematic of the Transfer Learning Process. This diagram illustrates the workflow where a large botanical dataset is used for initial AI model training (Task 1), followed by further refinement of the model with a small medical dataset (Task 2), highlighting the stages of pretraining and training for the application in medical imaging (Adapted from Mari et al, 2020)

We intend to reutilise the model downstream for medicine but, once the system is complete, we will have a template that we can adapt to many other uses. To develop the idea, we will use the huge botanical diversity of Kew Gardens, taking photos of plants with smart phones to start building a library of images. Our team will be in a group of 4. The team will consist of a botanist, a photographer, a light assistant and a scribe. If possible we will attempt to ensure that the smartphones lack AI enhancement- to give truer images. The photography will be systematic and include the different parts of each plant. At the same time, a botanist will identify the plant species and their key features to provide the important labelling needed for machine learning. The scribe will be noting down key information about each plant. We will do two data collection trips; one week we will visit the Temperate House and the next we will visit the Palm House. We intend to collect a large number of diverse, high-quality images that focus on the outlines and edges of plants because these are often particularly important for image recognition and classification. The photography sample will also include ‘red herrings’, which are items that may look like a plant, to help the system learn how to recognise false positives. Once complete, this comprehensive library of images and labels will become a dataset for training the computer vision model and beginning the process of transfer learning.

**Expected Results**

Upon completion, we anticipate that our botanically derived dataset will enable the creation of an AI model with enhanced diagnostic capabilities in medical imaging. By leveraging the diverse array of plant imagery, we aim to showcase the viability of transfer learning from botany to medicine, addressing data scarcity and ethical concerns in medical AI development. While we expect this method to yield a model with broader learning and application potential, we are also mindful of the challenges in ensuring the model's clinical relevance due to the distinct nature of plant versus human tissues.

**References**

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