Heuristic Oncological Prognosis Evaluator (HOPE): A Novel Approach Implementing a Deep Learning Convolutional Neural Network Framework to Detect Brain Cancer, Breast Cancer, Colorectal Cancer, and Lung Cancer

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Cancer is the common name used to categorize a collection of diseases. In the United States, there are an estimated 1.8 million new cancer cases and 600,000 cancer deaths. Though it has been proven that an early diagnosis can significantly reduce the metastasis of cancer, screenings for cancers are inaccessible to a majority of the world. Machine learning approaches are increasingly successful in image-based diagnosis, disease prognosis, and risk assessment. Currently, there is no machine learning model that has an accuracy of 90 percent in diagnosing multiple cancers: brain cancer, breast cancer, colorectal cancer, and lung cancer. The purpose of this project was to create HOPE, the Heuristic Oncological Prognosis Evaluator, a transfer learning diagnostic tool for the screening of patients with common cancers. By applying this approach to datasets of MRI and histopathological images, HOPE 2.0 demonstrates an overall accuracy of 95.52 percent in classifying brain cancer, breast cancer, colorectal cancer, and lung cancer. HOPE 2.0 is a unique model, as it possesses the ability to analyze multiple types of image data: radiology and pathology images. As most algorithms possess an accuracy in the 80-90 percent range and focus on one specific type of image data, HOPE 2.0 is a state-of-the-art model. HOPE 2.0 may ultimately aid in accelerating the diagnosis of these cancers, resulting in improved clinical outcomes, when compared to previous research which focused on singular cancer diagnosis.