1. Research Question: To develop a machine learning model to predict and classify breast cancer tumor cells into benign and malignant and predict the degree of malignancy of each tumor.

I was able to develop a random forest for predicting the class of the breast cancer tumor (benign/malignant) with 95% accuracy and developed a linear regression model for predicting the degree of malignancy of tumor explaining 89% of the variance in our dataset through clump thickness, bland chromatin, and uniformity in the cell size.

1. My findings agree with the existing literature and conforms that accurate machine learning models must be developed for early breast cancer diagnosis. My project provides a highly accurate and reliable machine learning model for predicting breast cancer tumor class and its degree of malignancy. The studies have shown that detecting breast cancer early through screening techniques can reduce the associated mortality by 13-16%.[1] Therefore, this project shows that machine learning models can help speed up the process of diagnosis and the right intervention can prevent a benign tumor from becoming malignant if diagnosed early.
2. The original dataset was collected over time using fine-needle aspiration (FNAs) technique, and malignant tumors were confirmed histologically. The original literature utilizing this dataset used a mathematical method called multisurface pattern separation which is a linear programming-based method and is used to distinguish between 2 different patterned datasets.[2] The authors used the 11 parameters of breast cytology to show and confirm that the method is also applicable to the diagnosis of breast cancer and can help classify them. Using linear programming, they were able to correctly classify 369/370 samples (~99% accuracy), out of which 201 of them were benign and 169 malignant. Since then, there have been various other computational analyses done on this dataset, using high level machine learning algorithms such as support vector machine,[3] convolutional neural network,[4] to classify these tumor types, with their respective accuracy being around ~95-97%.

In this project, I developed a simple machine learning model using well known methods like logistic regression model and random forest to achieve an appreciable accuracy and was able to come up with a novel prediction of degree of malignancy using PCA and linear regression under the guidance of Dr. Brian Cox.

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