



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Alan Lee	Project Number J1409
Project Title Machine Learning for Distinguishing Benign from Malignant Liver Tumors	
<p style="text-align: center;">Abstract</p> <p>Objectives Liver cancer is the second deadliest cancer in the world. Due to the multitude of lesions found within the liver, locating a specific lesion and determining its malignancy is a challenging yet urgent task. The objective of this study was to investigate machine learning's ability to distinguish benign and malignant liver tumors and to evaluate how effective such differentiation would be.</p> <p>Methods A total of 838 liver tumor MRI scan images from published papers were collected and grouped into the four scan types T1 No Contrast, T1 Arterial, T1 Interstitial, and T2. Next, I derived an additional 634 cropped images by focusing on the lesion area. The 1472 images thus obtained were used to train and test a convolutional neural network (CNN) model implemented with Python Keras library. 80% of the images were randomly selected for training and the remaining 20% for testing. A confusion matrix was used to measure the accuracy of the model.</p> <p>Results Training the cropped images in combination with the original images yielded accuracies of 81% for T1 Arterial, 78% for T1 No Contrast, 79% for T1 Interstitial, and 85% for T2, a significant improvement from when only original images were used for training. Testing all 1472 images together regardless of the scan type was 81% accurate in predicting whether the lesion was malignant or benign.</p> <p>Conclusions This study showed that machine learning (ML) model could successfully distinguish malignant and benign liver tumors. Cropping images to give the ML model a focus point around the lesion area improved the decision accuracy. Testing the four scan type groups individually also provided a quadruple cross-check on results and precision. Future studies will involve training with larger quantities of data and the creation of synthetic images to further increase accuracy.</p>	
Summary Statement I analyzed if machine learning could be effective at distinguishing benign and malignant liver tumors.	
Help Received I received help from my computer science teacher, Jared Lera, who introduced Convolutional Neural Network to me. Special thanks to my mother who provided guidance and online library access to images.	