



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Patrick Cui; Stephanie Zhang</b>	<b>Project Number</b> <b>S0811</b>
<b>Project Title</b> <b>PocketOnco: An App for Diagnosis-Prognosis of Colorectal, Breast, and Skin Cancer Using Convolutional Neural Networks</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> To (1) develop a more effective and accurate convolutional neural network (CNN) algorithm to validate, identify, and classify colorectal, breast and skin cancer through feature segmentation and (2) integrate a machine learning model into a mobile app platform with potential treatments and clinical trials.</p> <p><b>Methods</b> H&amp;E-stained pathologist pre-labeled breast histology slides were obtained from the online public 2018 Breast Cancer Histology Image (BACH) Grand Challenge. Colorectal histology slides were obtained from the 2015 Gland Segmentation Challenge Contest (GlaS). External dermoscopic images of skin cancer were obtained from the International Skin Imaging Collaboration (ISIC) Archive. Data augmentation techniques were then used to increase the datasets to a total of 5, 000 images. After testing both the CreateML framework in XCode and the Turi Create module in Jupyter Notebook, we compared the two network model accuracies and selected the model with the greater accuracy to be used within the app. We then developed the app in Swift with bridges to Objective-C, and potential treatments and clinical trials were encoded using JSON with reference to the American Society of Clinical Oncology (ASCO) and the U.S. National Library of Medicine.</p> <p><b>Results</b> The final network exhibited an accuracy of 100% for validation for all cancers, diagnosis accuracy of 96%, 78% and 75% and prognosis accuracy of 76%, 97%, and 80% for skin, colon, and breast, respectively. Using a confusion matrix, we identified a sensitivity of 64.29%, 91.87% and 100% and specificity of 68.75%, 85.71% and 92.31% for colorectal, breast and skin cancer diagnosis, respectively.</p> <p><b>Conclusions</b> PocketOnco is a novel, user-friendly iOS app that grades and stages colorectal, breast, and skin cancer through the integration of a custom deep convolutional neural network algorithm. The mobile app platform allows for the exploration of personalized medicine and healthcare, with the rise of electronic health records, novel treatments, and clinical trials.</p>	
<b>Summary Statement</b> A multi-cancer diagnosis-prognosis app was developed to grade and stage colorectal, breast, and skin cancer through the integration of CNNs which analyze imported histology images or taken dermoscopic images.	
<b>Help Received</b> All data was acquired from public sources online. Neural network implementation, algorithm design, and app development were done independently without external guidance.	