# CALIFORNIA STATE SCIENCE FAIR
# 2015 PROJECT SUMMARY

**Name(s)**

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**Project Number**

**S1229**

**Project Title**

## A Novel Cancer Diagnosis Framework Using Optimal Point Region Growing Segmentation and Pseudo-Zernike Moments

**Abstract**

**Objectives/Goals**

Cancer is the second most common cause of death in the US. Early diagnosis is the key to cure cancer and increase the patient's survival rate. The current computer aided diagnosis (CADx) system usually needs several iterations for segmenting the lesion and requires the extraction of many features for classification. It also lacks a common framework. The objective of this project is to design and develop a CADx common framework to simplify the diagnosis process and more efficiently and accurately diagnose cancers in their early stages.

**Methods/Materials**

The framework consists of automatic segmentation of a lesion using Optimal Point Region Growing Segmentation, reconstruction of the segmented lesion using Pseudo-Zernike moments, and Supported Vector Machine (SVM) classification of the lesion using the single feature, Root Mean Square (RMS) of Pseudo-Zernike moments. This novel CADx framework was implemented using MATLAB and validated on the mammographic images and the dermoscopic images from the Mammographic Image Analysis Society (MIAS) database and the published study examples, respectively.

**Results**

A comparative study among the various algorithms was performed on the selected mammographic images and dermoscopic images. The results demonstrated that the newly developed framework has over 86% average recognition rate, further improved the accuracy of Tahmasbi#s CADx algorithm by 7.56%, and reduced the False Negative Rate (FNR) and False Positive Rate (FPR) by 7.24% and 3.48%, respectively.

**Conclusions/Discussion**

This study has developed a novel CADx common framework to simplify the diagnosis process and more efficiently and accurately diagnose breast cancer and melanoma from a mammographic image and dermoscopic image, respectively. It has improved the best benchmark of recognition rate by 8%. The new framework is generic and can be used for diagnosing different types of cancers.

**Summary Statement**

This study has not only developed a novel CADx framework to more efficiently and accurately diagnose breast cancer and melanoma but also laid a foundation for diagnosing other type of cancers.

**Help Received**

Dr. James Li helped on the selection of the mammographic image database and provided feedback for my project. He also recommended "Digital Image Processing using MATLAB " by Rafael Gonzalez, which helped me to master my MATLAB image processing skills.