



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

Name(s) Amol Singh	Project Number S0828
Project Title STAC-STIC: Novel Computational Pipeline to Generate Digital Super-Resolution Static Representations of Pathology Slides	
<p style="text-align: center;">Abstract</p> <p>Objectives Accurate digital pathology image analysis depends on high quality images. As such it is imperative to obtain digital images with high resolution for downstream data analysis. While hematoxylin and eosin (H&E) stained tissue section slides from solid tumors contain 3-dimensional information; this data has been ignored in digital pathology. In addition, in cytology and bone marrow aspirate smears, the 3-dimensional nature of the specimen has precluded efficient analysis of such morphologic data. An individual image snapshot at a single focal distance or of a single scene is often not sufficient for accurate diagnoses and multiple whole slide images at different focal distances are necessary for diagnosis.</p> <p>Methods I describe a novel computational pipeline and processing program for obtaining a super-resolved image from multiple static images at different z-planes from a single microscopy video. This program STAC-STIC, in part, uses MULTI-Z, a program that constructs a final super-resolution image, as well as a novel image alignment and stitching program: V-STIC. This program performs image alignment, Gaussian smoothing, Laplacian filtering, homography calculation, perspective warp, and array manipulation to construct the final super-resolution static slide representation.</p> <p>Results I applied this algorithm and program to images of cytology and H&E stained sections and demonstrate significant improvements in both resolution and image quality by objective data analyses (24% increase in sharpness and focus).</p> <p>Conclusions With the use of our program, super-resolved Whole Slide Images (WSI) images of cytology and H&E stained tissue sections can be obtained to allow for optimal downstream computational analysis, hospital documentation, easy proliferation and collaboration, and can serve as the medium for the primary diagnosis. This method is applicable to whole slide scanned images.</p>	
Summary Statement This software uses slow-motion videos to generate images of stained cytology slides that preserve vital 3D information, a promising advance over current 2D digital methods and a path to earlier, faster, and more accurate primary diagnosis.	
Help Received I received help with access to training data and troubleshooting any issues in the project.	