



# CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

<b>Name(s)</b> <b>Shruti Aggarwal</b>	<b>Project Number</b> <b>J0701</b>
<b>Project Title</b> <b>Is It a Match? Image Resolution and Its Impact on Face Recognition</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> My experiment dealt with the impact of reduced image clarity (grainy and blurred due to still images captured from video) on face recognition, and further examined the relative contribution of the Internal features (eyes, nose, and mouth) and External features (hair, jaw-line) to face recognition.</p> <p><b>Methods/Materials</b> Experiment 1: Use 10 high-resolution color frontal images of different celebrities, normalized by removing the background. Make all 10 images grainy and blurry. Obtain informed consent and test volunteers on each celebrity image, starting from most blurred to the least, and record results. Experiment 2: Generate 3 additional images with only External features, only Internal features, and only Internal Features spatially displaced, for each of the 10 celebrity images. Make the images grainy and blurry. Obtain informed consent and test volunteers on each of the images, starting from most blurred to the least, and record results. Confirm familiarity with the celebrity by showing the participant the reference set (Original high resolution image).</p> <p><b>Results</b> Experiment 1: Recognition declined to 79% at clarity level 8. Experiment 2: Internal Features Displaced recognition dropped to 3% at clarity level 8 from 38%. Internal Features alone were recognized at only 34% at clarity level 8. External Feature recognition was 30% at high resolution declining to 15% at clarity level 8.</p> <p><b>Conclusions/Discussion</b> In Experiment 1, most participants recognized 8 out of 10 images. Yet, my research showed most automatic face recognition systems are unable to replicate this performance. So how do humans recognize faces? What is the relative contribution of the internal and external features? What is the significance of the spatial configuration of the nose, eyes and mouth? Experiment 2's results suggest that under real world degraded image conditions, recognition is more holistic and is served by Internal features and their placement relative to External features. External features are poor indicators on their own but provide the context for the Internal features. This finding can be used to adjust the system algorithms and serve applications related to Biometrics Security for Law Enforcement and Access Control; and entertainment applications such as automatic tagging of photographs.</p>	
<b>Summary Statement</b> I studied how humans recognize images from surveillance cameras and experimented with components of the face to determine their role in recognition.	
<b>Help Received</b> My mom taught me Adobe Photoshop. My teachers permitted me to test students during class.	