# Exploring Images

**Subject Area(s)**  
Science & technology

**Associated Unit**  
None

**Associated Lesson**  
None

**Activity Title**  
Exploring Images

**Header**  
Insert Image 1 here, right justified to wrap

<table>
<thead>
<tr>
<th>Image 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADA Description:</strong> Students using programming to process images in different ways</td>
</tr>
<tr>
<td><strong>Caption:</strong> Students performing image processing</td>
</tr>
<tr>
<td><strong>Image file name:</strong> exploring_images1.jpg</td>
</tr>
<tr>
<td><strong>Source/Rights:</strong> Copyright 2010 Pavel Khazron. Used with permission.</td>
</tr>
</tbody>
</table>

**Grade Level**  
6-8

**Activity Dependency**  
Image Scanner!

**Time Required**  
50 minutes

**Group Size**  
3

**Expendable Cost per Group**  
US$0
Summary
Students learn about different ways in which images can be manipulated using computer programs. Using the Processing programming environment, students modify example programs to produce different effects on given images: brightening or darkening an image, cropping sections from images, image rotation, and zooming.

Engineering Connection
After an image has been read or scanned into a computer, a digital artist or an image processing engineer often has to find ways of improving or modifying images to suit an application. For example, some images taken in dark conditions, such as under water, need to be made brighter to make the subjects appear more visible. At times, only a small part of an image is of interest, such as occurs in photographs of crowds. Image zooming (or magnification) is used to make small or far-away features appear larger. Finally, image rotation may be needed to level images taken under an angle, as for example in space photography.

Engineering Category
Category 3: Engineering analysis or partial design

Keywords
Image, sense of sight, image editing, programming

Educational Standards
- New York state intermediate-level science: Standard 1: T1.4b, T1.5a
- New York state technology: engineering design, information systems, computer technology

Pre-Requisite Knowledge
Ability to open, modify, and run a programming sketch written in Processing.

Learning Objectives
After this activity, students will be able to:
- Explain what kind of processing a given image may require
- Understand how image editing software can be used to improve image appearance
- Know how to modify and run programs written in a computer programming language

Materials List
Each group needs:
- One laptop or desktop computer with Processing 1.0.8 programming environment and attached programs and images
Introduction/Motivation

Editing images is often needed for various purposes. Have you even taken an image with a digital camera to find that it appears too dark? How about action photographs as in sports (conduct a discussion)?

We will experiment with the following ways of processing images: brightness adjustment, cropping, rotation, and zooming. These are perhaps the most important and useful image editing techniques. Consider the following types of images acquired by a digital camera and think about which one of the four named techniques can improve how the image appears.

- A photograph of a deep sea wildlife taken by a submersible craft
- Image captured while on a roller coaster
- Surveillance photograph of a subject taken on a street in a business section of the city
- Photograph of the space shuttle taking off

Vocabulary/Definitions

<table>
<thead>
<tr>
<th>Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image editing</td>
<td>Altering the way an image appears.</td>
</tr>
<tr>
<td>Brightness adjustment</td>
<td>Altering an image by adding or subtracting a fixed number from all image pixels.</td>
</tr>
<tr>
<td>Cropping</td>
<td>Selecting and removing a small area of interest in an image.</td>
</tr>
<tr>
<td>Rotation</td>
<td>Rotating an image about some point to change the orientation.</td>
</tr>
<tr>
<td>Zooming</td>
<td>Magnification of an image so distant objects appear larger.</td>
</tr>
<tr>
<td>Sketch</td>
<td>A name for a computer program written in the language Processing</td>
</tr>
</tbody>
</table>

Procedure

Before the Activity

- Unzip and copy the contents of the Programs folder to student computers.

With the Students

1. The four programs in the provided folder each contain one modifiable constant. All constants can be modified following the first example below.

2. **Brightness adjustment** Open the folder Programs/brightness. Then open the programming sketch brightness.pde.
   a. The program adds or subtracts a number called constant from every pixel in the image. Run the program with constant set to 0 by assigning zero as int constant = 0; What do you observe? Now change constant to a small positive number, for example 5. Run and notice whether the image appears brighter. Try different numbers as well as images. To try a different image, for example garden, replace the line Image = loadImage(“../Images/boat.png”); with Image = loadImage(“../Images/garden.png”); Different sample images are located in the Programs/Images folder.
b. Notice how some pixels change color unexpectedly when constant is set to either a sufficiently large or small number. This is because pixels have values 0 to 255, and larger numbers are “wrapped” around. For example, if constant is 15, 245 + constant = 260. However, the displayed value will actually be 4 (Why?).

3. **Cropping** Open the folder Programs/cropping. Then open the programming sketch cropping.pde.
   a. The program selects and removes (crops) a rectangular area of an image. The removed piece is displayed under the original image.
   b. Select an area to crop. To do so, modify the numbers x, y, dx, and dy. Numbers x and y are the x and y coordinates of the upper left hand corner of the cropped piece, and numbers dx and dy are its width and height. Run the sketch and observe results.
   c. Run the sketch with the image tabletennis. Challenge: try to crop the white tennis ball!

4. **Rotation** Open the folder Programs/rotating. Then open the sketch rotating.pde.
   a. This sketch rotates an image by an angle of 0 to 90 degrees. To modify the angle, assign a number between 0 and 90 to the constant angle.
   b. Try rotating boat in increments of 5 degrees.
   c. Pick an angle to make the box held by the salesman in the salesman image appear horizontal.

5. **Zooming** Open the folder Programs/zooming. Then open the sketch zooming.pde.
   a. In zooming.pde, the constant zoomfactor controls the amount of zooming. With zoomfactor greater than 1, the zoomed image appears larger, while having zoomfactor less than 1 shrinks the image.
   b. Try zoomfactor equal to 0.5. This will make the image twice smaller. Now try setting zoomfactor to 2. When the number is greater than 1, can you better discern the image details?

**Attachments**
Programs.zip

**Troubleshooting Tips**

**Investigating Questions**

**Assessment**

**Pre-Activity Assessment**
*Sharing Experiences:* Lead a class discussion about student experiences with photography in general.

**Activity Embedded Assessment**
*Analysis:* Encourage collaboration.

**Post-Activity Assessment**
What Have We Learned?: Conduct a discussion with the same theme as in the pre-activity assessment.

Activity Extensions
Have students look at the examples provided with Processing, and think of creative ways to modify the examples using the four image processing techniques they have experimented with.

Activity Scaling None

Additional Multimedia Support None

References

Redirect URL http://gk12.poly.edu/amps-cbri/

Owner Pavel Khazron

Contributors Pavel Khazron

Copyright Copyright © 2010 by Polytechnic Institute of NYU. The development of this activity was supported by Project AMPS under a GK-12 Fellows grant 0807286 from the National Science Foundation.

Version: January, 2010