Lesson 6: Images in The Theater

45 minutes

Overview

How can I create image filters using The Theater?

Students apply their knowledge of 2D arrays and object-oriented programming to create image filters using The Theater. Students learn how images are made up of pixels and that pixels consist of red, green, and blue color values and explore the `Image` and `Pixel` classes. Students write pseudocode to create an image filter that sets a specific color value to zero and then implement their algorithm in Java.

Standards

Full Course Alignment

CSA Conceptual Framework

▶ **MOD-2** - Programmers use code to represent a physical object or nonphysical concept, real or imagined, by defining a class based on the attirbutes and/or behaviors of the object or concept

Agenda

Warm Up (10 minutes)
- **Image Filters**

Activity (30 minutes)
- **Images and Pixels**
- **Creating Image Filters**

Wrap Up (5 minutes)
- **Glows, Grows, Want-to-Knows**
- **Assessment: Check for Understanding**
- **AP Classroom Topic Questions**

Objectives

Students will be able to:

- Declare and initialize a two-dimensional (2D) array of objects
- Differentiate between returning an object and a primitive value
- Traverse a two-dimensional (2D) array of objects

Preparation

- Print copies of the Creating Image Filters handout and manipulatives (one for each pair of students)
- (Optional) Cut out the manipulatives from the Creating Image Filters handout
- Check the **Teacher's Lounge** for verified teachers on the CSA Forum to find additional strategies or resources shared by fellow teachers

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the students

- **Creating Image Filters** - Handout
- **U5L6 Extra Practice** - Handout

Vocabulary

- **RGB** - a color model consisting of red, green, and blue lights to display images
- **pixel** - the smallest unit of information in an image

Teaching Guide

Warm Up (10 minutes)

Image Filters

Remarks

> For the unit project, we will create a personal narrative using The Theater that consists of images that have been manipulated with image filters and effects.

Discuss: Click through the animated slide to display the prompts.

- *Where have you seen image filters used? Why do we use them?*
- *How do you think software engineers decide what new image filters to add to apps and programs?*

Discussion Goal: Students share examples of apps and programs with image filters, such as social media apps and photo editing programs. Students suggest that image filters are used to enhance the visual appeal or mood of images. Students share ideas about how new image filters are chosen and developed, such as creating image filters that are similar to popular ones.

Remarks

> As software engineers, you will get to create your own image filters!

Discuss: *What kind of image filters would you want to create?*

Discussion Goal: Students share examples of image filters they want to create, such as replicating or modifying existing ones that they like or creating a new one that they wish existing apps and programs had.

Activity (30 minutes)

Images and Pixels (15 minutes)

Remarks

> Before we get started creating our own image filters, we first need to understand how to work with images in our programs. Let's take a look at an example.

Do This: Review the lesson objectives.

Do This: Direct students to Level 1 on Code Studio to investigate the program with a partner. Students make the changes to the program as prompted.

1 **Investigate: Modifying Pixels**

Discuss: Click through the animated slide to display the prompts.

- *What do you notice about the code in this program?*

- *What do you wonder about the code in this program?*

Discussion Goal: Students notice that there is a 2D array of `Pixel` objects that is traversed to change the color values of each pixel in an image. Students may wonder how pixels are represented and how they can tell where a pixel is located in an image.

Display: Show the video – *Images and Pixels*.

Do This: Click through the animated slide to demonstrate how images are made up of pixels and pixels are made up of RGB color values.

Do This: Click through the animated slides to introduce the `Image` and `Pixel` classes:

- The `Image` class and its methods
- The `Pixel` class and its methods

Do This: Click through the animated slide to demonstrate getting a pixel from an image.

Do This: Click through the animated slide to explain that when the return expression is a reference to an object, a copy of that reference is returned, not a copy of the object.

Creating Image Filters (15 minutes)

Remarks

> Images are made up of pixels and can be represented as a 2D array of `Pixel` objects. Each pixel in an image consists of red, green, and blue color values. These values are instance variables of the `Pixel` class, which means we can obtain and modify these values using its accessor and mutator methods.

Group: Place students in pairs.

Distribute: Give each pair a copy of the Creating Image Filters handout and manipulatives.

Do This: Have students write pseudocode for an algorithm to set either the red, green, or blue color values to zero for each pixel in an image.

Do This: Have students compare their algorithms with another group and make revisions as needed.

Remarks

> Let's use what we now know about images and pixels to create some image filters!

Do This: Direct students to Level 2 on Code Studio to complete Levels 2 and 3. Students write a method to create a 2D array of `Pixel` objects on Level 2, then continue to Level 3 to complete a choice level to create an image filter.

2-3 **Creating Image Filters**

2 3

Teaching Tip

The `ImagePlus` class is revisited throughout the curriculum. Students develop the `ImagePlus` class in this lesson to practice traversing a 2D array of `Pixel` objects to create image filters. Students expand on this class to add new behaviors in upcoming lessons and units.

You can choose to ask students how creating an `ImagePlus` class is similar to creating the `PainterPlus` class. Have students consider what this means they can do with the `ImagePlus` class and additional subclasses they might create.

Remarks

> This is a good time to commit our code and save our `ImagePlus` class to the Backpack.

Do This: Play the music clip to cue committing their code and saving the `ImagePlus` class to the Backpack.

Wrap Up (5 minutes)

Glows, Grows, Want-to-Knows

Remarks

> You used your software engineering skills to work with images and pixels and create image filters. In the next few lessons, we will learn how to create additional image filters. You will also create your own image filters in the unit project to enhance the mood of the images you use in your personal narrative.

Discuss: Click through the animated slide to display the prompts.

- *What was awesome about writing your code?*
- *What is one action you can take to improve your code?*
- *What questions do you have about today?*

Discussion Goal: Students share aspects of their program they enjoyed or strengths of writing algorithms and identify areas of improvement to strengthen their programming skills. Students also share any questions or misconceptions they may have.

Do This: Review the concepts covered in this lesson.

Display: Key Vocabulary

Assessment: Check for Understanding

Check For Understanding Question(s) and solutions can be found in each lesson on Code Studio. These questions can be used for an exit ticket.

4 **Check for Understanding**

AP Classroom Topic Questions

To assign questions from the AP Classroom Question Bank that align with this lesson, create a custom quiz in AP Classroom by searching the Question Bank for the Essential Knowledge statements listed at the top of this lesson plan. You can find instructions and video demonstrations to do this on **AP Central**.

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