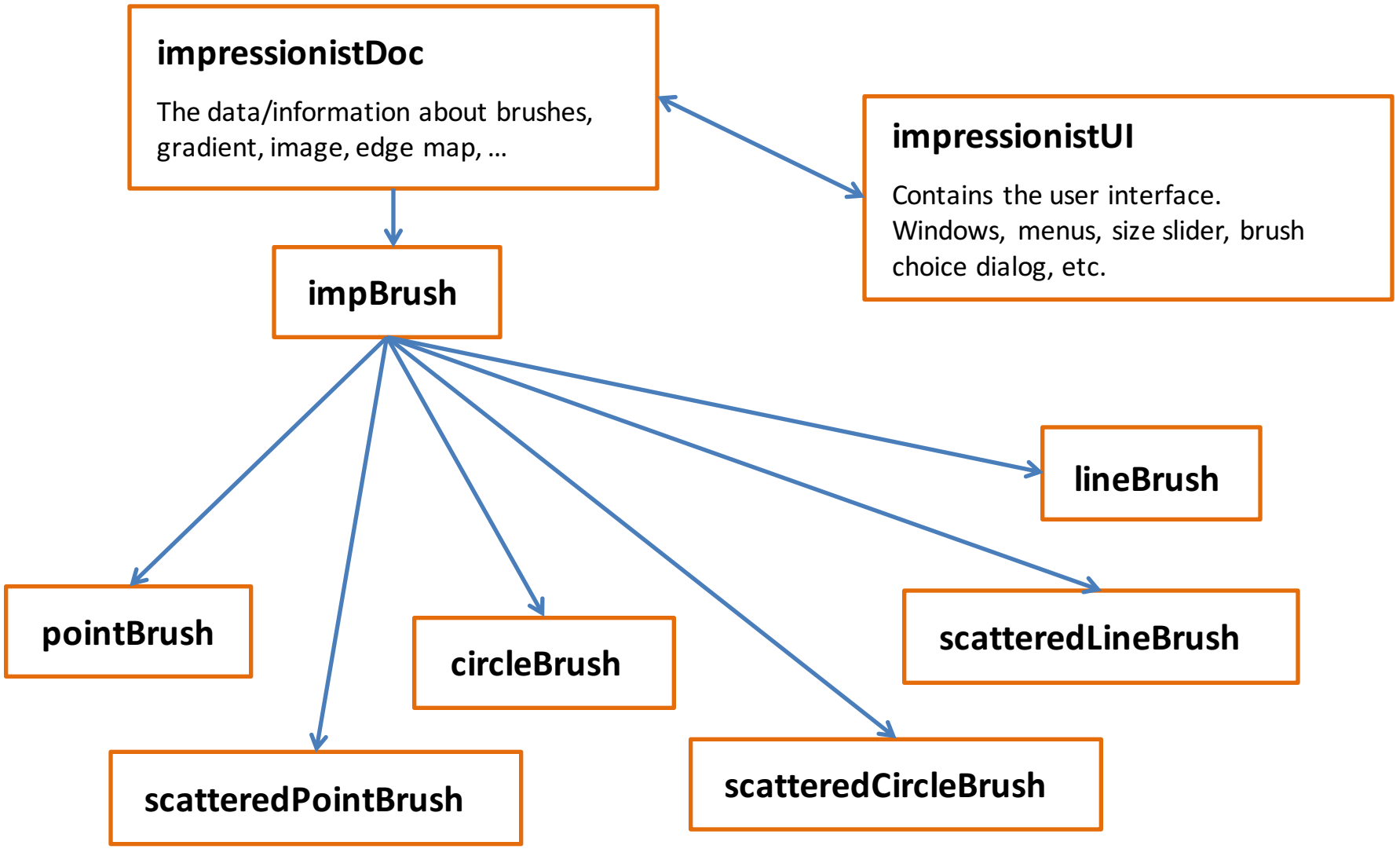
Impressionist Help Session

Overview

- Skeleton code
- OpenGL
- FLTK
- Requirements
  - Brushes
  - Alpha blending
  - Filter kernel
- Debugging hints
- Git tutorial (those who are familiar don’t have to stay)

Skeleton Code



impressionistDoc

Handles all of the document-related items, like loading/saving, etc

impressionistUI

Handles the UI components, such as getting values from sliders, setting up the window, etc

paintView

Handles the drawing side of the window the user paints on (right side). A lot of event handling is done here (good place to look for examples)

originalView

Handles the original image side of the window (left side)

impBrush

The virtual class all brushes are derived from

pointBrush

An example brush that draws points

OpenGL

- Great environment for PC 2d/3d graphics applications
- Extremely well documented
- We will be using it throughout the quarter
- This project uses the basics of OpenGL
  - Although you're welcome to learn more on your own, the focus of the project is on 2d image manipulation

How OpenGL Works

- OpenGL draws primitives – lines, vertexes, or polygons – subject to many selectable modes
- It can be modeled as a state machine
  - Once a mode is selected, it stays there until turned off
- It is procedural – commands are executed in the order they're specified

Drawing a Primitive

```
// Let's draw a filled triangle!

// first, set your color
glColor3f( red, green, blue );

// tell OpenGL to begin drawing
glBegin(GL_POLYGON);
      // specify vertices A, B, and C.
      glVertex2d( Ax, Ay );
      glVertex2d( Bx, By );
      glVertex2d( Cx, Cy );
// close the OpenGL block
glEnd();
// Force OpenGL to draw what you specified now
glFlush();
```

FLTK

- Stands for Fast Light ToolKit (pronounced fulltick)
- Cross-platform C++ GUI toolkit
- Completely event-driven (via callbacks)
- We'll use fltk 1.3.3
- impressionistUI.cpp has a lot of widget examples

Brushes

- Let's make a triangle brush! (this will not count towards extra credit)
- Make a copy of pointBrush.h/cpp and rename to triangleBrush.h/cpp and add to the impressionist project
- Go through the code and change all pointBrush labels to triangleBrush

Brushes, cont’d

- Go to impBrush.h and add BRUSH_TRIANGLE to the enum
- Open impressionistDoc.cpp, add triangleBrush.h to the includes. Scroll down a bit, and add triangleBrush to the selectable brushes.
- Go to impressionistUI.cpp and add the triangle brush to the brush menu

Brushes, cont'd

Modify the BrushMove method to draw a triangle instead of a point in triangleBrush.cpp

```
int size = pDoc->getSize();
int Ax,Ay,Bx,By,Cx,Cy;
Ax = target.x - (.5*size);
Bx = target.x + (.5*size);
Cx = target.x;
Ay = target.y - (.5*size);
By = target.y - (.5*size);
Cy = target.y + (.5*size);
glBegin( GL_POLYGON );
       SetColor( source );
       glVertex2d( Ax, Ay );
       glVertex2d( Bx, By );
       glVertex2d( Cx, Cy );
glEnd();
```

Edge detection & gradients

- The gradient is a vector that points in the direction of maximum increase of f

$$\nabla f = \frac{\partial f}{\partial x}\hat{x} + \frac{\partial f}{\partial y}\hat{y},$$

$$\theta = \operatorname{atan2}\left(\frac{\partial f}{\partial y}, \frac{\partial f}{\partial x}\right).$$

- Use the sobel operator

Alpha Blending

$F_{new} = \alpha C + (1-\alpha) F_{old}$

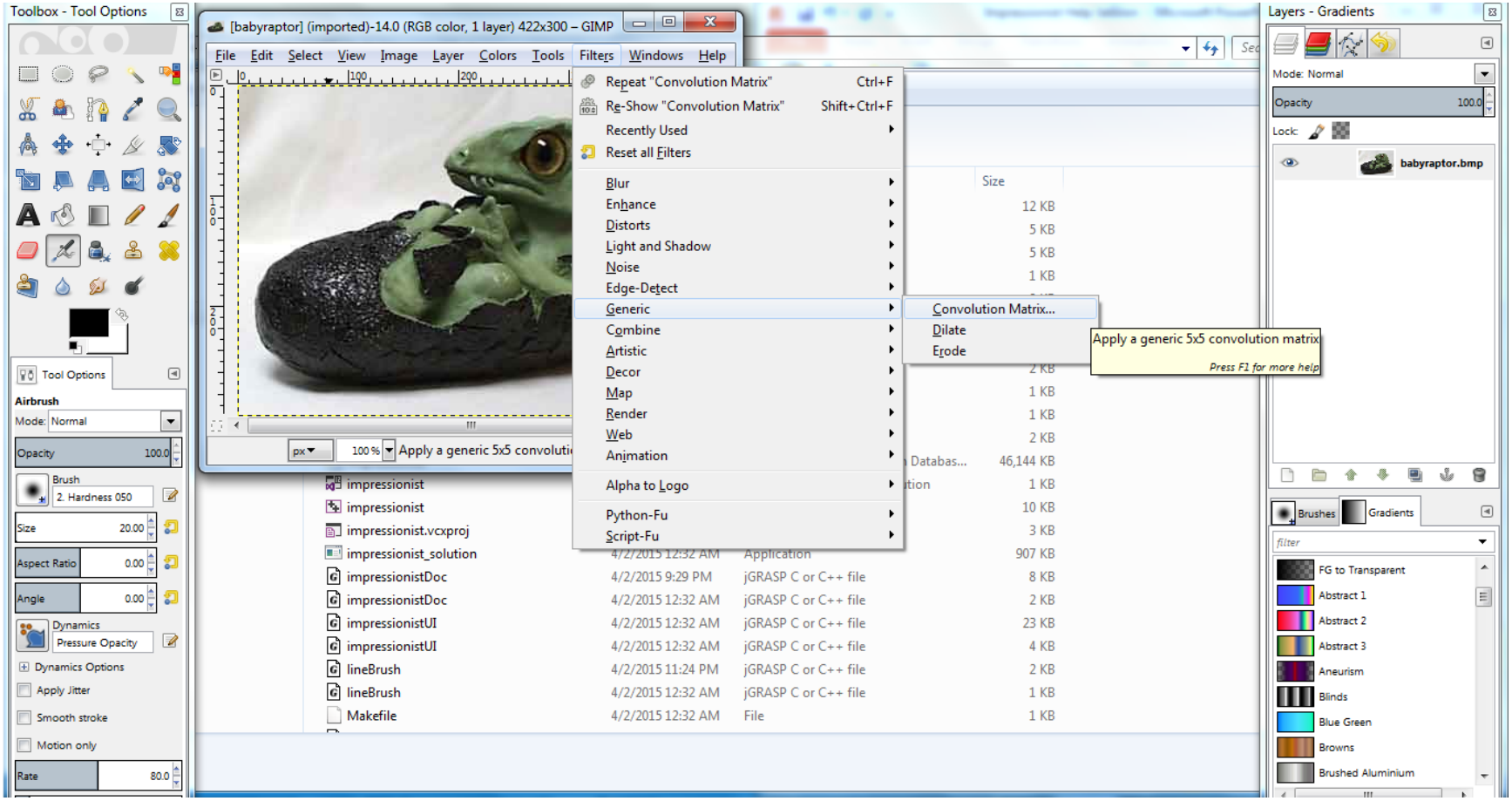
Make sure you call glBlendFunc outside the glBegin/glEnd block

Filters

- Remember how filter kernels are applied to an image
  - Look at the sample solution. How does it apply a filter?
  - What could go wrong?
  - What cases do you need to handle?

- We will be looking closely at your filter kernel

Use Gimp/Photoshop to see filters



Debugging

One thing that might help is to be checking for errors after each call. When it seems like nothing is happening, OpenGL is often returning an error message somewhere along the line. The begin-end block is a good possibility, and if that's the problem there will be an error code returned.

```
GLenum error_flag;

error_flag = glGetError();

if (error_flag != GL_NO_ERROR) {
     printf("Error: %1s (%i) in
     %1s.\n",gluErrorString(error_flag),
     error_flag,"method name");
}
```

Git

Resources

Basics for this course:

https://courses.cs.washington.edu/courses/cse457/15au/src/help.php#git

Official Documentation:

http://git-scm.com/book/en/v2

```
git --help <command>
```