CMPT 381 Assignment 4: Digital Ink, Stroke Selection, and Scaling

Due: Friday, March 22, 11:59pm

Overview

In this assignment, you will demonstrate your skills in Android touch interactions, and will build a system that works with digital ink and stroke-based input. Your system will support ink smoothing, stroke selection, and interactive scaling. You will also build on your experience with Model-View-Controller including the InteractionModel class.

Part 1: Smoothed Ink Input

Build a simple sketching tool in Android that allows the user to draw "ink" strokes on a canvas using touch. The raw ink input will be smoothed, turning the points of the raw input into a Path object comprised of several quadratic curves.

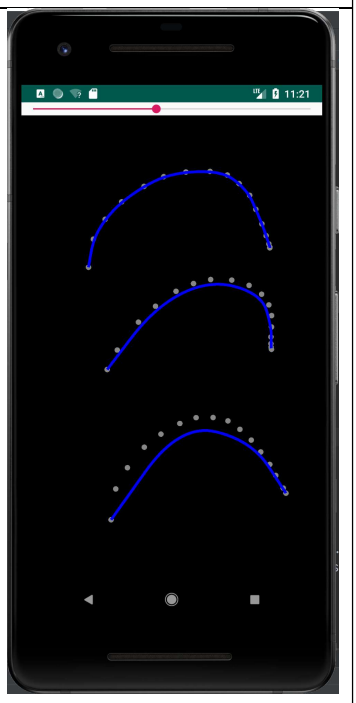
Interface requirements:

- A custom drawing panel that fills the main part of the screen (no scrolling required); this is where the user draws ink strokes
- A horizontal slider that appears above the drawing panel, to control the degree of smoothing (see below)

Interaction requirements:

- Touching and dragging on the main panel draws a green line that follows the touch (i.e., the raw ink)
- When the touch lifts off, the ink is converted to a smooth stroke and is shown in blue (the green ink disappears at this point, but the points of the raw ink are shown as grey dots). (Note that the raw ink points are stored with the stroke in the model as well as the smooth path)
- The slider ranges from 1-10 and controls the degree of "thinning" that occurs when the raw ink is converted to a smooth stroke. If the thinning value is 1, then every raw ink point is used in the smooth stroke; if the thinning value is 10, then every tenth point is used.

Raw ink line created as user touches and drags on the view. When user lifts their finger, the raw ink is converted to a stroke.



Top: stroke with thinning = 1. Middle: stroke with thinning = 3. Bottom: stroke with thinning = 5. All strokes show original ink points as grey dots

Software requirements:

- Implement the system using Model-View-Controller, with correct separation between these components
- Create separate classes for the Model, the View, the Controller, and the InteractionModel, following examples given in class
- Implement publish-subscribe communication to notify Views of changes to the Model
- The interaction model should store the raw ink as the user draws; the ink can then be passed to the model to create a stroke
- Build the system using the following classes:
    - SketchMainActivity: entry point and setup for the app
    - SketchModel: data model that stores all smoothed paths
    - SketchPath: class to represent one path in the model
    - SketchView: custom view to display both the raw ink and the smoothed paths in the model
    - SketchListener: interface to enable publish-subscribe communication between model and view
    - SketchController: controller class to handle touch events
    - InteractionModel: class to store the raw ink input and perform smoothing

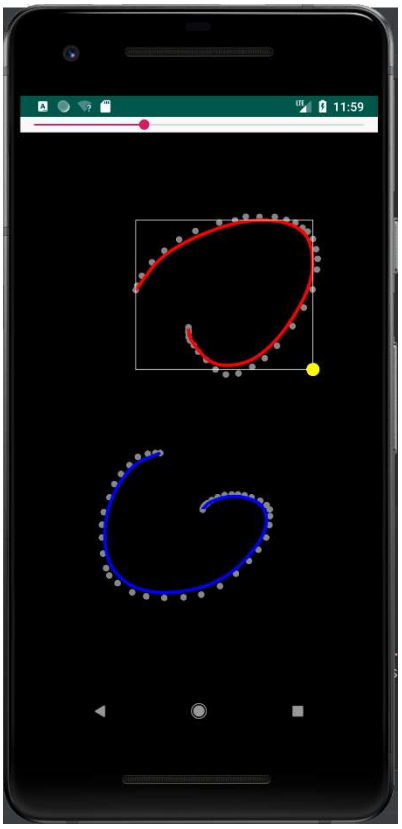
How to smooth raw ink input:

- The basic idea behind smoothing an ink stroke is to replace the lines connecting each input point with curves. We will use quadratic curves (which are easier to implement than cubic curves). There are two parts to the process: first, *thinning* to reduce the density of points in the ink stroke, and *smoothing* to create curves from the remaining points.
- *Thinning*: Given a list of raw input points **rawPoints** and an integer **thinning**, create a new list **thinnedPoints** that contains the first and last points of **rawPoints** plus each equally-spaced point indicated by **thinning**. For example, if **thinning** is 1, take every point from **rawPoints**; if **thinning** is 2, take every other point; if **thinning** is 10, take every tenth point, etc.
- *Smoothing*. From list **thinnedPoints**, create a new Path **smoothed** with the following constraints:
    - start at the first point in **thinnedPoints** (using the **Path.moveTo** method)
    - for each pair of points **p1** and **p2** in **thinnedPoints** (e.g., points 1 and 2, points 2 and 3, etc.):
        - assign **midX** to be the average of **p1.x** and **p2.x**, and assign **midY** to be the average of **p1.y** and **p2.y**
        - add a new quadratic curve to **smoothed** (using the **Path.quadTo** method) with arguments **p1.x**, **p1.y**, **midX**, **midY**
- The new path **smoothed** can then be added to the model (remember to also store the raw ink with the path).

Resources for part 1:

- Tutorial for custom Views in Android: https://developer.android.com/training/custom-views/index.html
- API for Android SeekBar (slider widget): https://developer.android.com/reference/android/widget/SeekBar.html
- API for Android Path class: https://developer.android.com/reference/android/graphics/Path.html
- Simple sketchpad example from lab: in Examples folder on the course Moodle

Part 2: Selection and Interactive Scaling



In the second part of the assignment you will extend your system from part 1 to provide the user with additional capabilities: selection of individual strokes, and the interactive translation and scaling of a selected stroke.

Additional interaction requirements:

- The capabilities described above (for part 1) all remain in the system
- When the user touches on an existing stroke, the selected stroke is drawn in red and shows a bounding box and resize handle (see picture at right).
- If the user drags after touching a stroke, the stroke translates according to the drag
- If the user touches on the background and releases without moving, then any selection is canceled (and no new ink is drawn)
- If the user drags the resize handle of a selected stroke, the stroke will resize according to the drag (see below)
- If the user moves the "thinning" seekbar while a stroke is selected, it will change the stroke according to the new thinning value.

Additional software requirements:

- When resizing, you should transform all of the points of the original raw ink with each movement of the handle, and recreate the smooth path as needed
- The same basic idea applies to translating and re-thinning: work with the original ink points, and recreate the smoothed stroke as needed
- Your controller should extend the state machine created for part 1 to handle the additional interactions
- Your resize operation does **not** need to handle negative scale factors (so, you can assume that the user will not drag the resize handle further than the top-left corner)

This assignment is to be completed individually; each student will hand in an assignment.

What to hand in

- Android: a zip file of your Android Studio project folder for either part 1 (if that is as much as you have completed) or part 2. If you have completed part 2, you do not have to hand in a separate project file for part 1.
- A readme.txt file that indicates exactly what the marker needs to do to run your code.

Where to hand in

Hand in your two files (one zip and one readme.txt) to the link on the course Moodle.

Evaluation

Marks will be given for producing a system that meets the requirements above, and compiles and runs without errors. Note that no late assignments will be allowed, and no extensions will be given, without medical reasons.