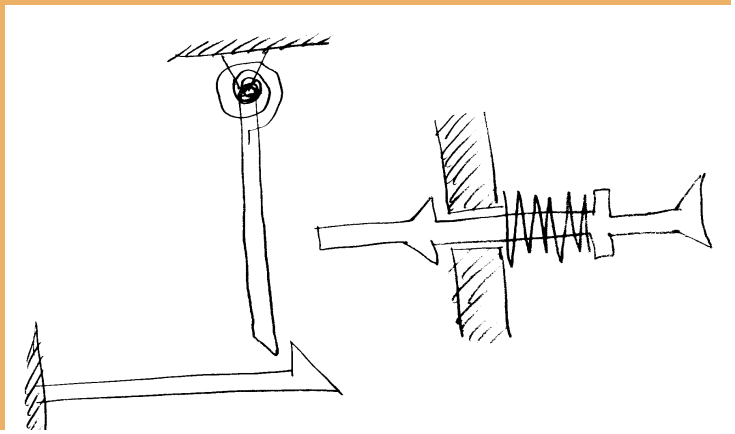
How To Build a Sketch Based Interface

Tevfik Metin Sezgin,
Michael Oltmans,
Randall Davis

Consider This Device...



Our Vision

Our Model

- The designer sketches with pen and paper
- The observer interprets the sketch
- The observer and designer interact

Demo

- Conceptual mechanical design
- Client
  - Low level sketch understanding
  - Recognize sketch as mechanical device
- Server
  - Simulate the recognized device

How did we get here?

- Low level sketch processing
- Domain level recognition
- Connection to existing design tools

Today's goals

- Learn to use the low level recognition toolkit
- Learn how to build a simple sketching interface with the toolkit
- Build your own interface to Xfig

- And now, on to the Toolkit...

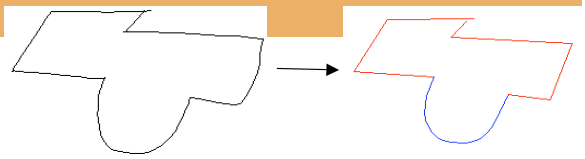
Toolkit functionality

Given a freehand stroke, generate a geometric primitive

- Lines

- Circles

- Curves

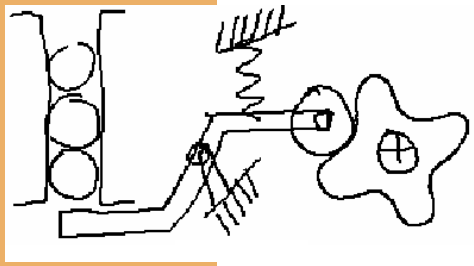


The Toolkit doesn't do...

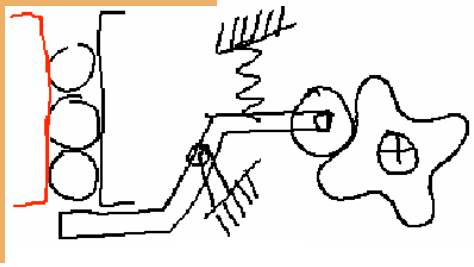
- Higher level recognition (i.e., can't recognize squares, rectangles, domain specific shapes)
- Gesture recognition

Terminology

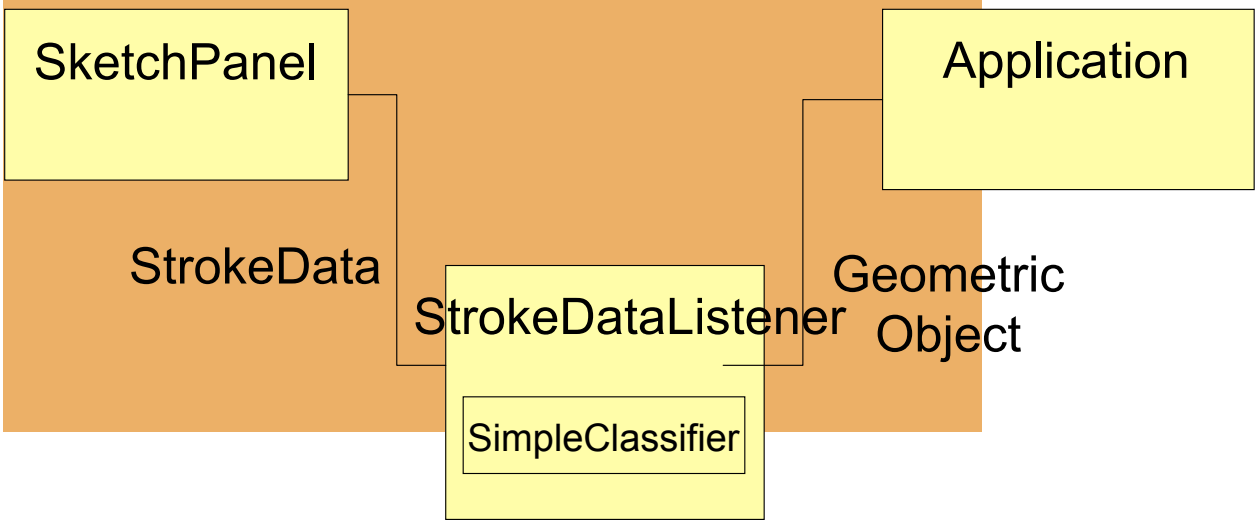
Sketch: Informal, messy diagrams consisting of several strokes



Stroke: Array of timestamped points collected between pen down and pen up events



Structure of an application



Package hierarchy

- edu.mit.sketch.fig (SketchFig.java)
- edu.mit.sketch.toolkit
  - Recognition related classes are here
- edu.mit.sketch.geom
  - The geometry package
- edu.mit.sketch.ui
  - User interface related classes

Classes you will use most often

edu.mit.sketch.ui
- SketchPanel

edu.mit.sketch.toolkit
- StrokeData
- SimpleClassifier

· edu.mit.sketch.geom
- GeneralPath
- Polygon
- Line
- Ellipse
- Point
- Rectangle

edu.mit.sketch.ui

- SketchPanel
  - extends javax.swing.JPanel
  - Gathers stroke data
  - Displays raw strokes as they are drawn
  - Has methods for adding and removing StrokeDataListeners

edu.mit.sketch.toolkit.StrokeData

- This class holds and computes stroke related information such as points in the stroke, pen speed, curvature...
- The constructor takes an array of points
- SketchPanel creates this object after each mouse up event

edu.mit.sketch.toolkit.SimpleClassifier

- Constructor takes a StrokeData object
- Has a method int classify()
- This method returns an int indicating the type of the approximation generated by the toolkit
- Compare the result against the following using a switch statement
  - SimpleClassifier.LINE
  - SimpleClassifier.ELLIPSE
  - SimpleClassifier.POLYGON
  - SimpleClassifier.COMPLEX

edu.mit.sketch.toolkit.SimpleClassifier

- One can also check for a particular type by
  - SimpleClassifier.isLine()
  - SimpleClassifier.isEllipse()
  - SimpleClassifier.isPolygon()
  - SimpleClassifier.isComplex()

edu.mit.sketch.toolkit.SimpleClassifier

- Once the type is determined, the approximation can be accessed by
  - Line getLineApproximation()
  - Ellipse getEllipseApproximation()
  - Polygon getPolygonApproximation()
  - GeneralPath getComplexApproximation()

Putting it all Together

```
public class XFigFrontend
extends SketchPanel
implements StrokeDataListener {

    public XFigFrontend ( ) {
        addStrokeDataListener( this );
    }

    public void handleStroke( StrokeData stroke_data )
        SimpleClassifier classifier =
            new SimpleClassifier( stroke_data );

        switch( classifier.classify() ) {
            case SimpleClassifier.LINE:
            ...
        }
    }
```

How to get started

Compile and run

- "make classpath" – only need to do this once for each shell window
- "make" – compiles the java files
- java SketchTest

See how it uses the toolkit and the SimpleClassifier

Best strategy for understanding the control flow: find the handleStroke() method in TicTacToe.java

How to get started

- Compile and run
  - javac SketchTest.java
    - Java is not Python! ALWAYS recompile after making changes
  - <correct any errors!>
  - java SketchTest
    - don't include the ".class" part of the name when running
- Try compiling and running MyTTT (assuming I can find it)
- See how it uses the toolkit and the SimpleClassifier
- Best strategy for understanding the control flow: find the handleStroke() method in TicTacToe.java

Resources

- Javadoc documentation is included with toolkit
  - mozilla ~/assist/doc/index.html
- Questions: contact Metin Sezgin mtsezgin@ai.mit.edu