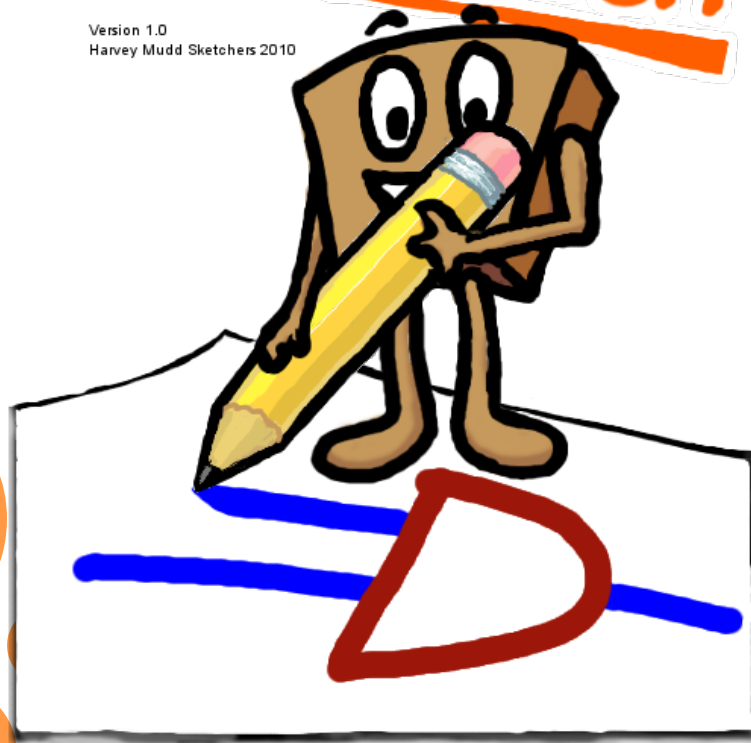


LogiSketch

Version 1.0
Harvey Mudd Sketchers 2010



An Intuitive System
for Sketching and
Simulating Logic
Circuits

Kevin Chan, Lilian de Greef, Alexa Keizur, Alice Paul
Brian Liao, June Woo Suk (Troy High School)
Professor Christine Alvarado

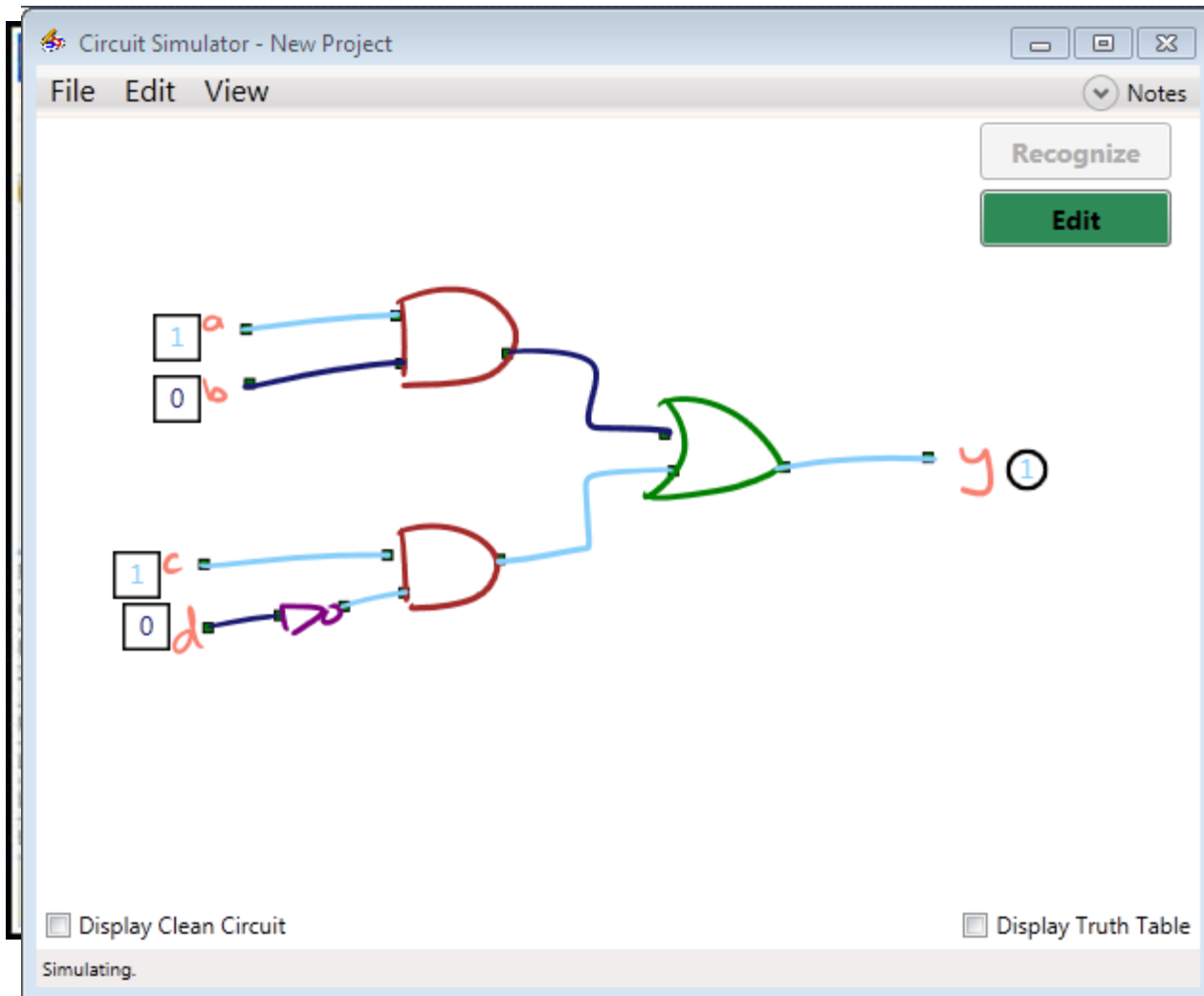
BIG PICTURE

Q: How do you make sketch recognition reliable without restricting the user's drawing style?

A: Allow the user to draw freely, with no unnatural constraints. Then design the system based on common sketching styles.



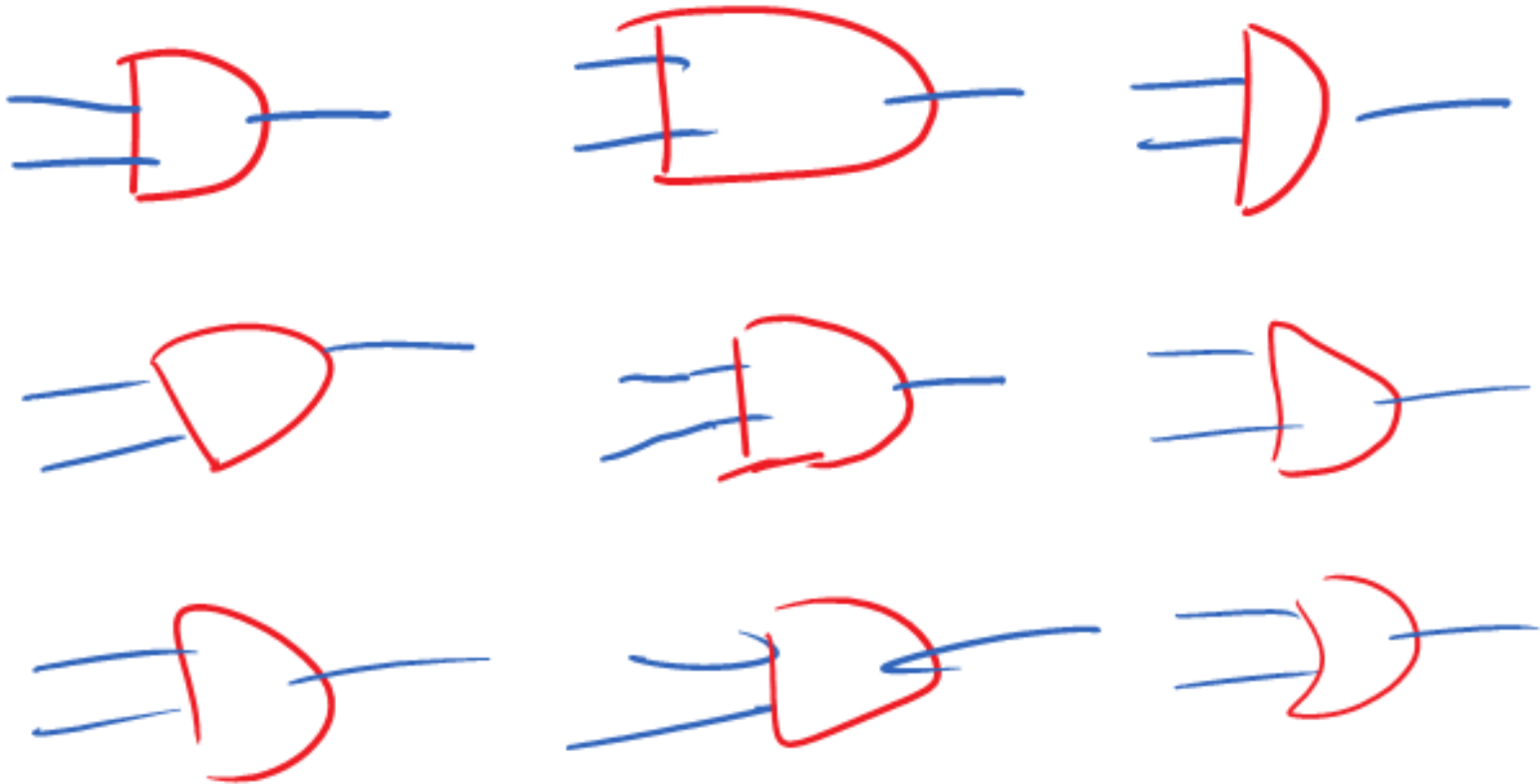
INTRODUCTION

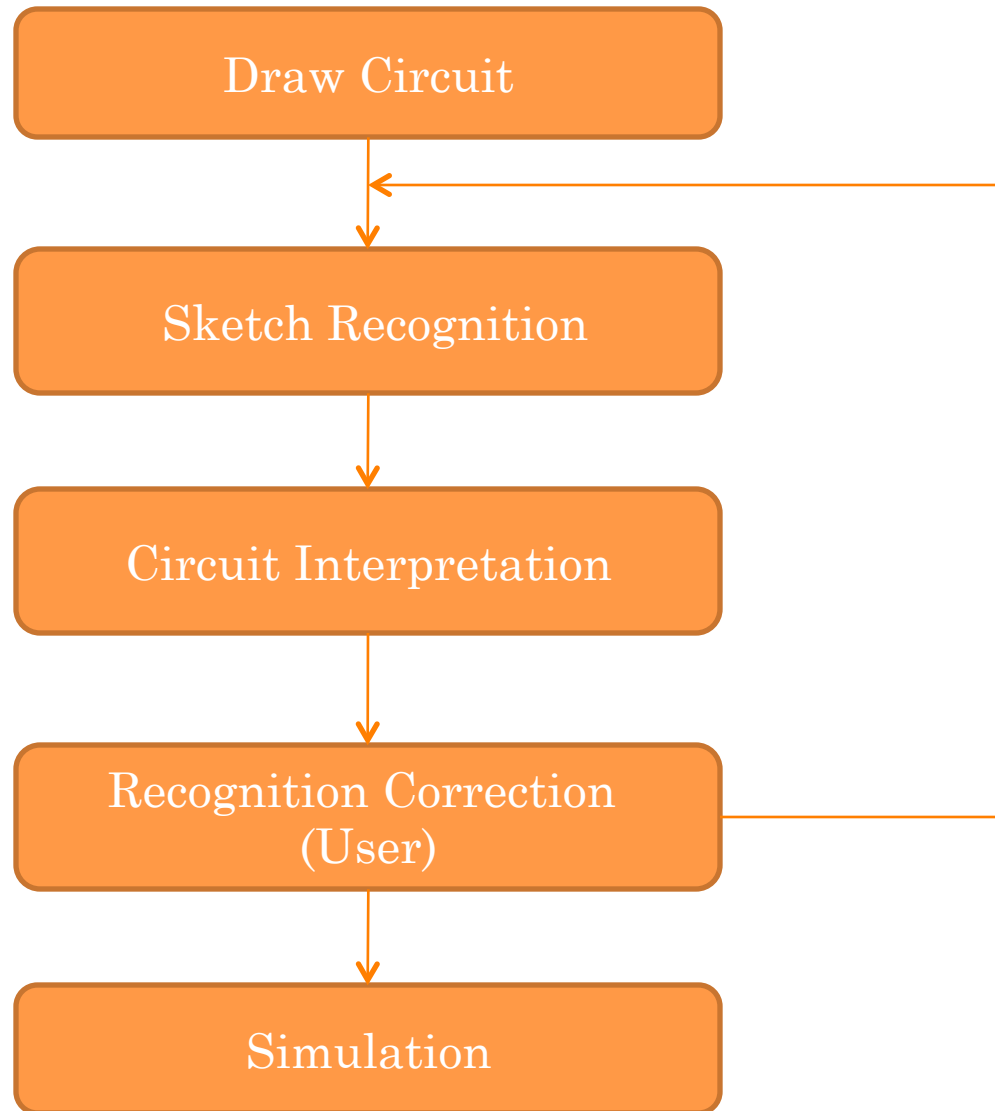


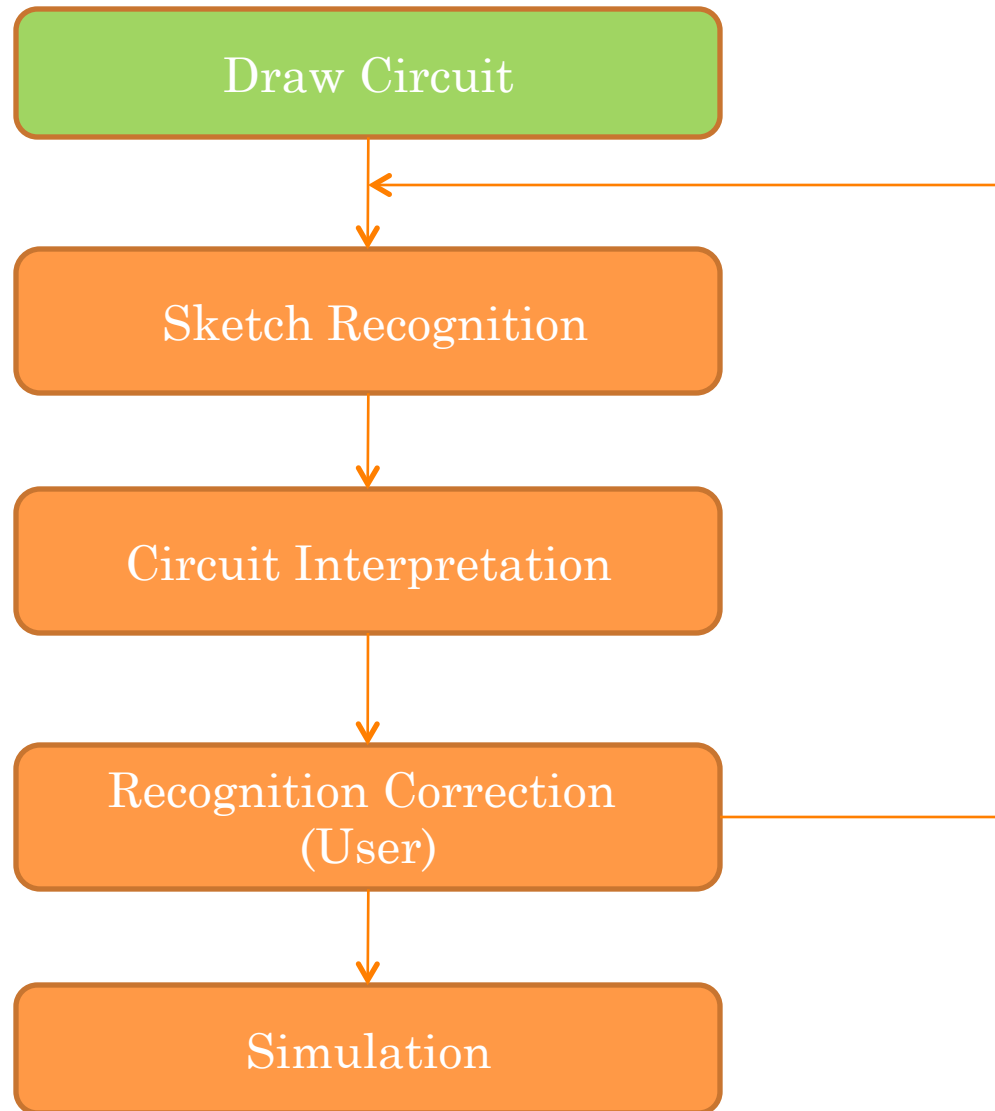
DEMO!

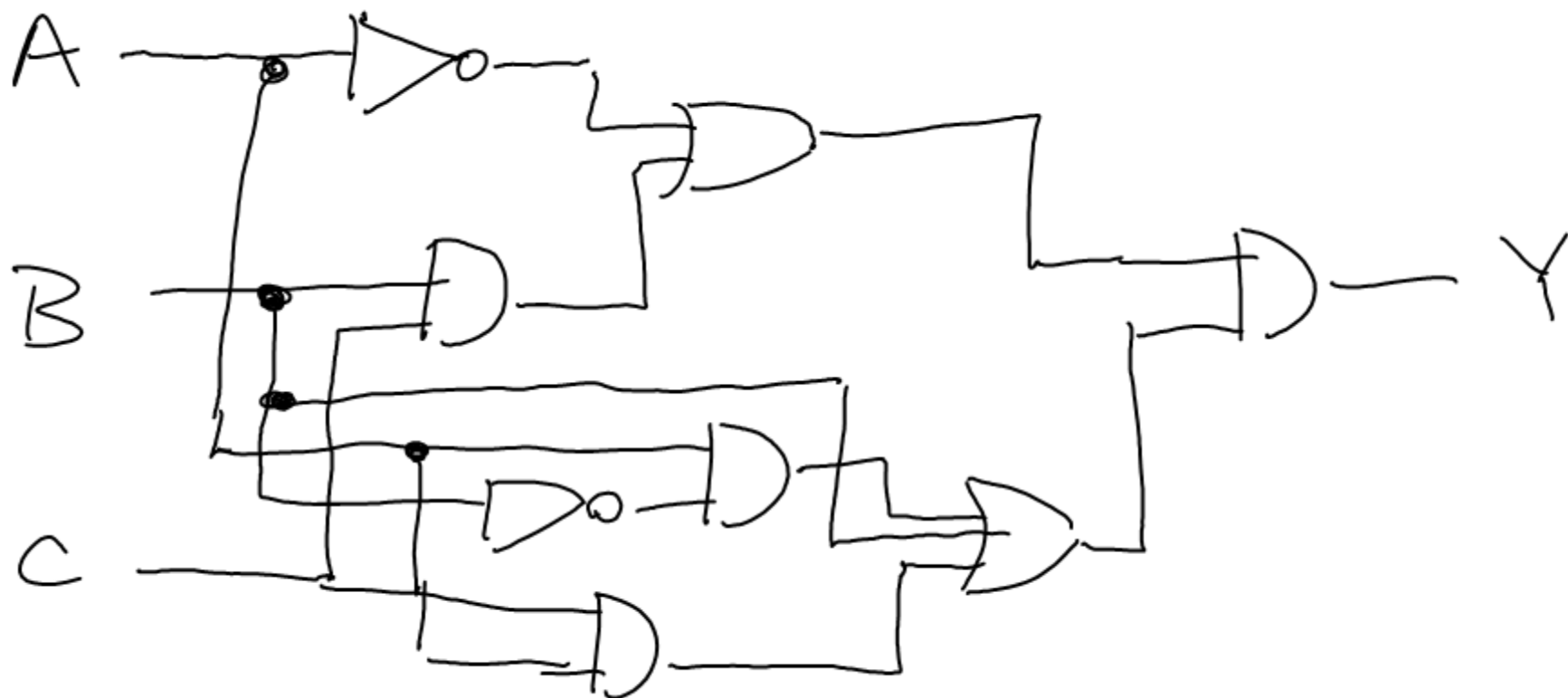


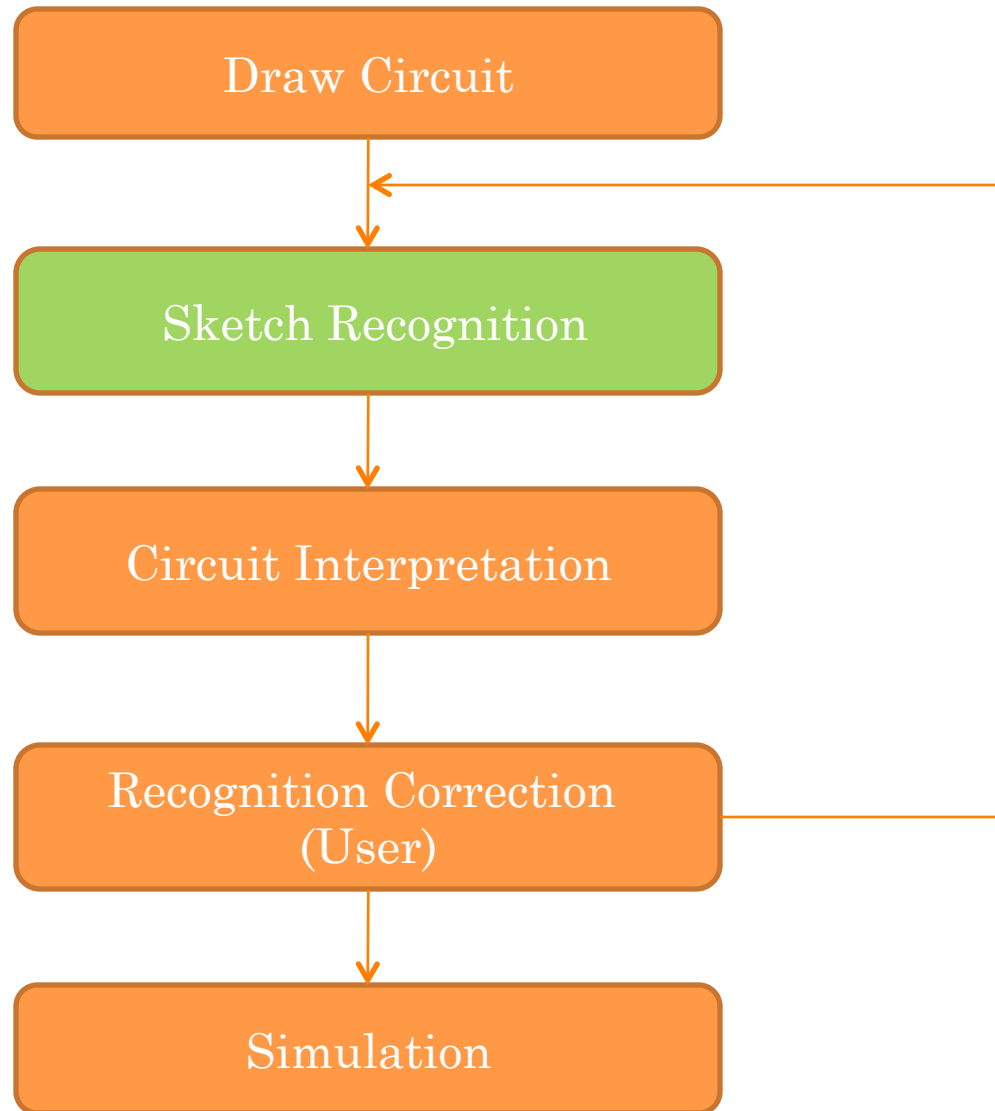
RECOGNITION CHALLENGES



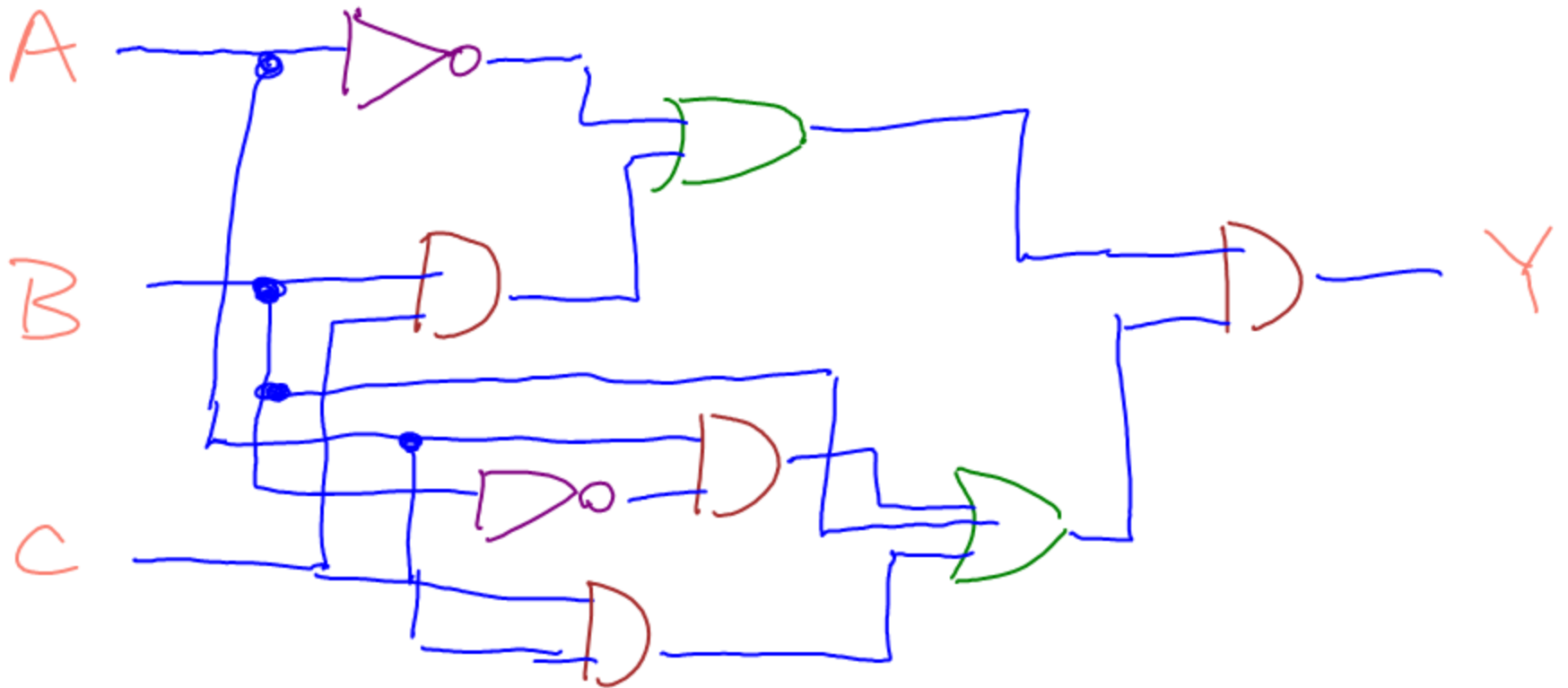




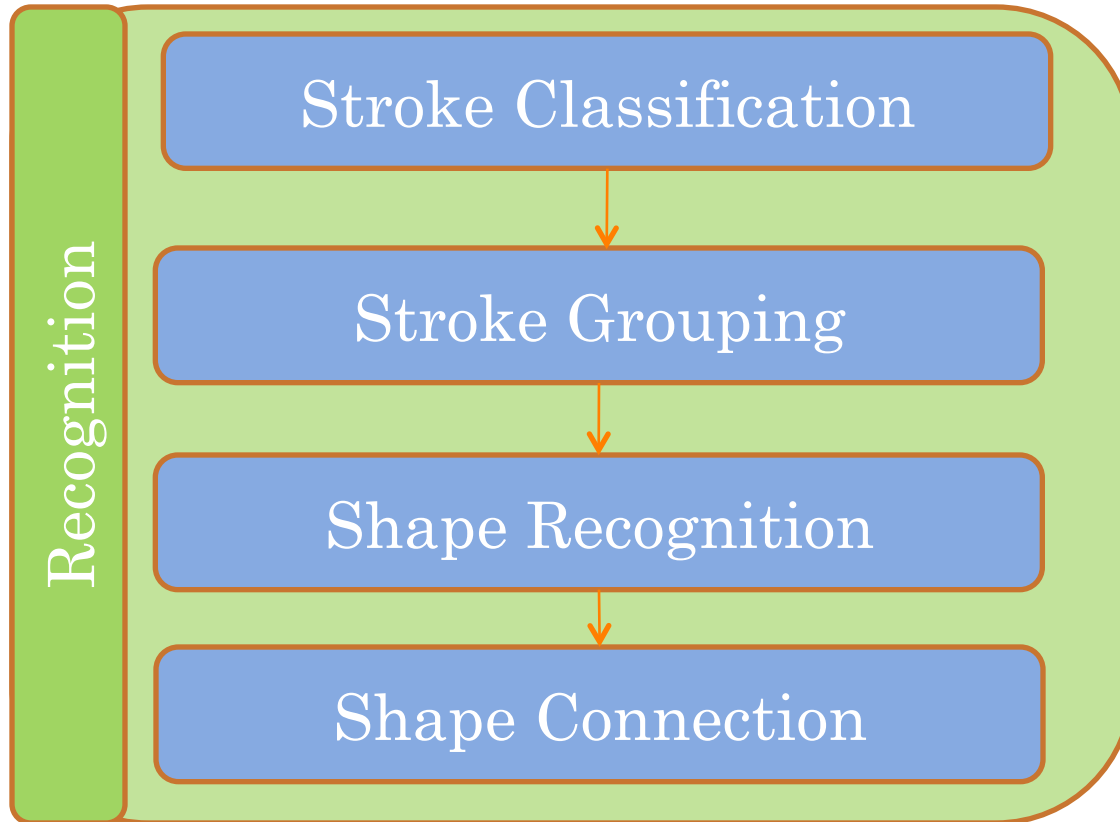




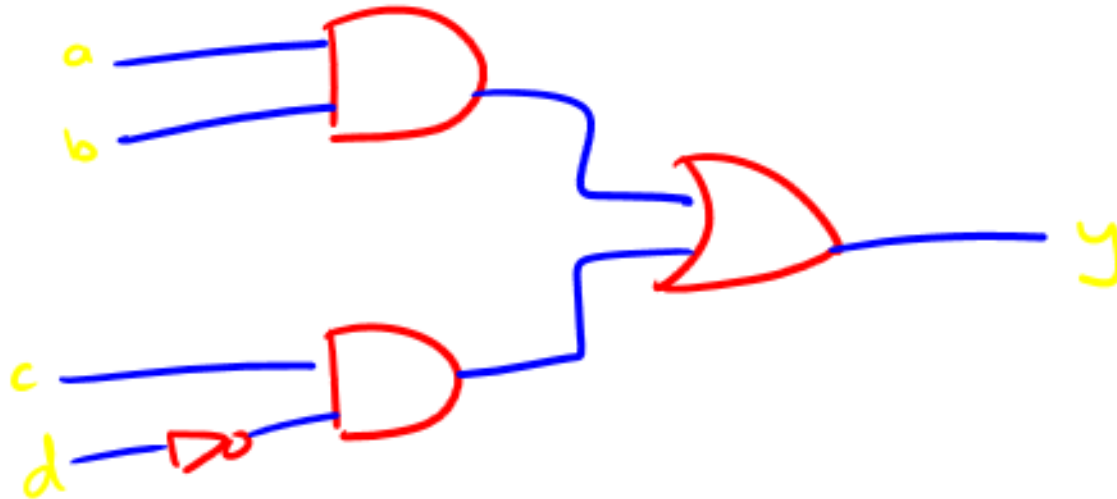
RECOGNITION OVERVIEW



PREVIOUS RECOGNITION METHOD



RECOGNITION



Stroke Classification



Stroke Grouping



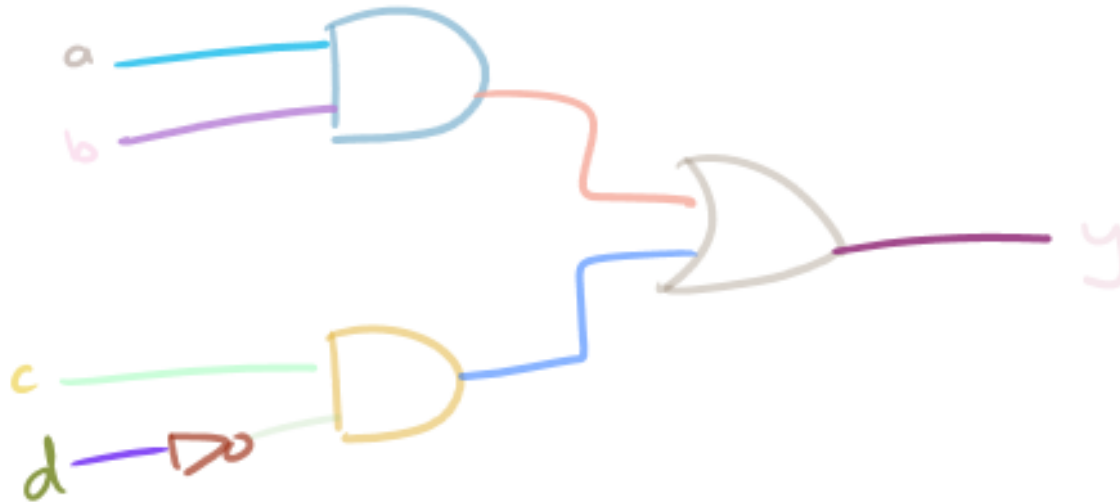
Shape Recognition



Shape Connection



RECOGNITION



Stroke Classification



Stroke Grouping



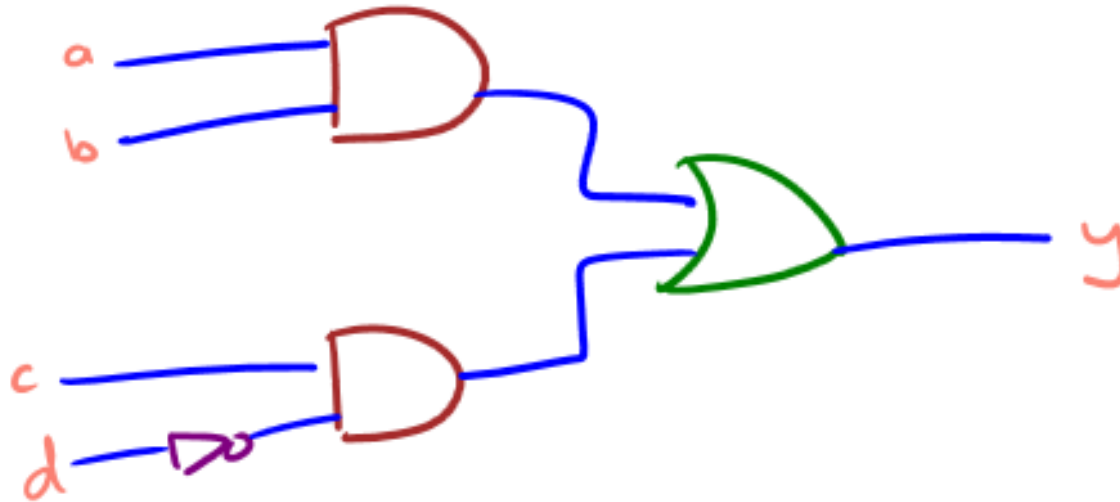
Shape Recognition



Shape Connection



RECOGNITION



Stroke Classification



Stroke Grouping



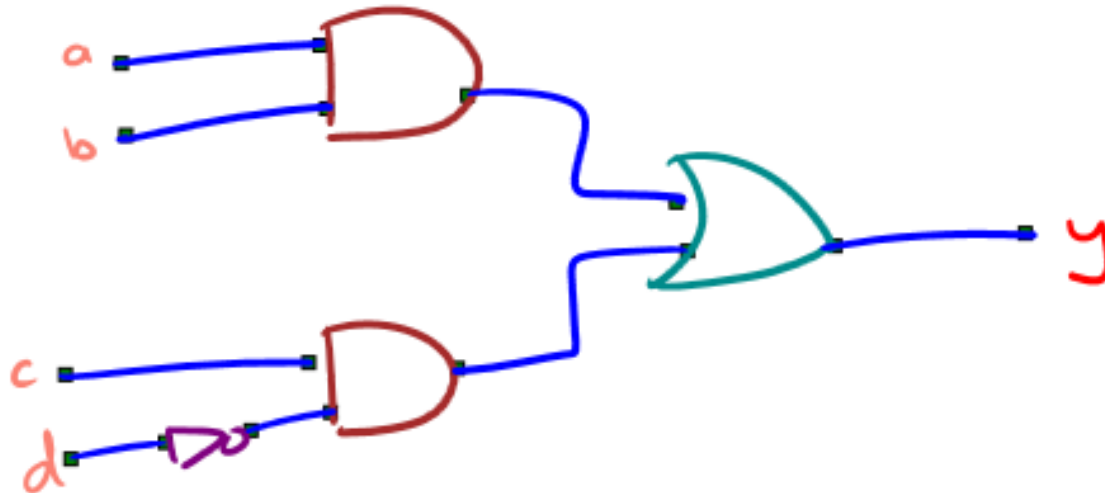
Shape Recognition



Shape Connection



RECOGNITION



Stroke Classification



Stroke Grouping



Shape Recognition

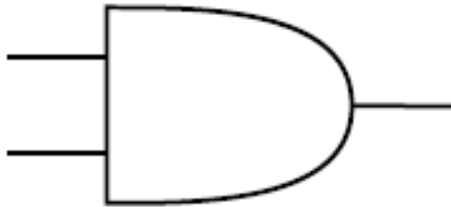


Shape Connection

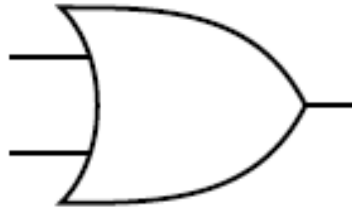


RECOGNITION

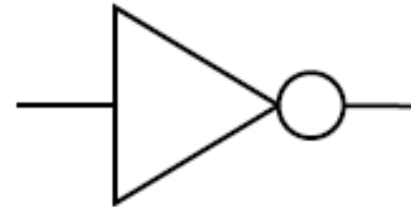
- How does a computer recognize a shape?
- How do you, as a person, recognize a shape?



AND



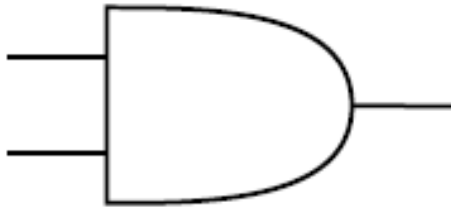
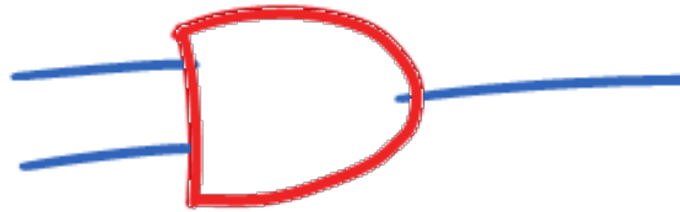
OR



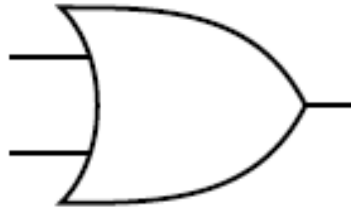
NOT



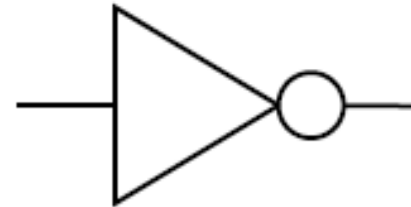
RECOGNITION WITH TEMPLATES



AND



OR

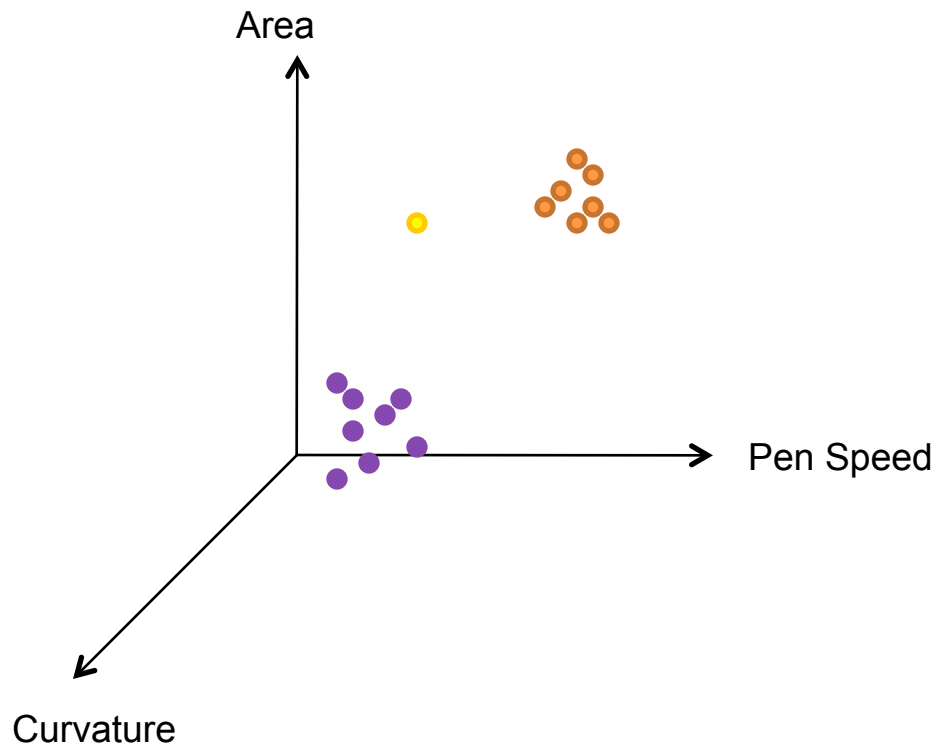


NOT



RECOGNITION WITH FEATURES

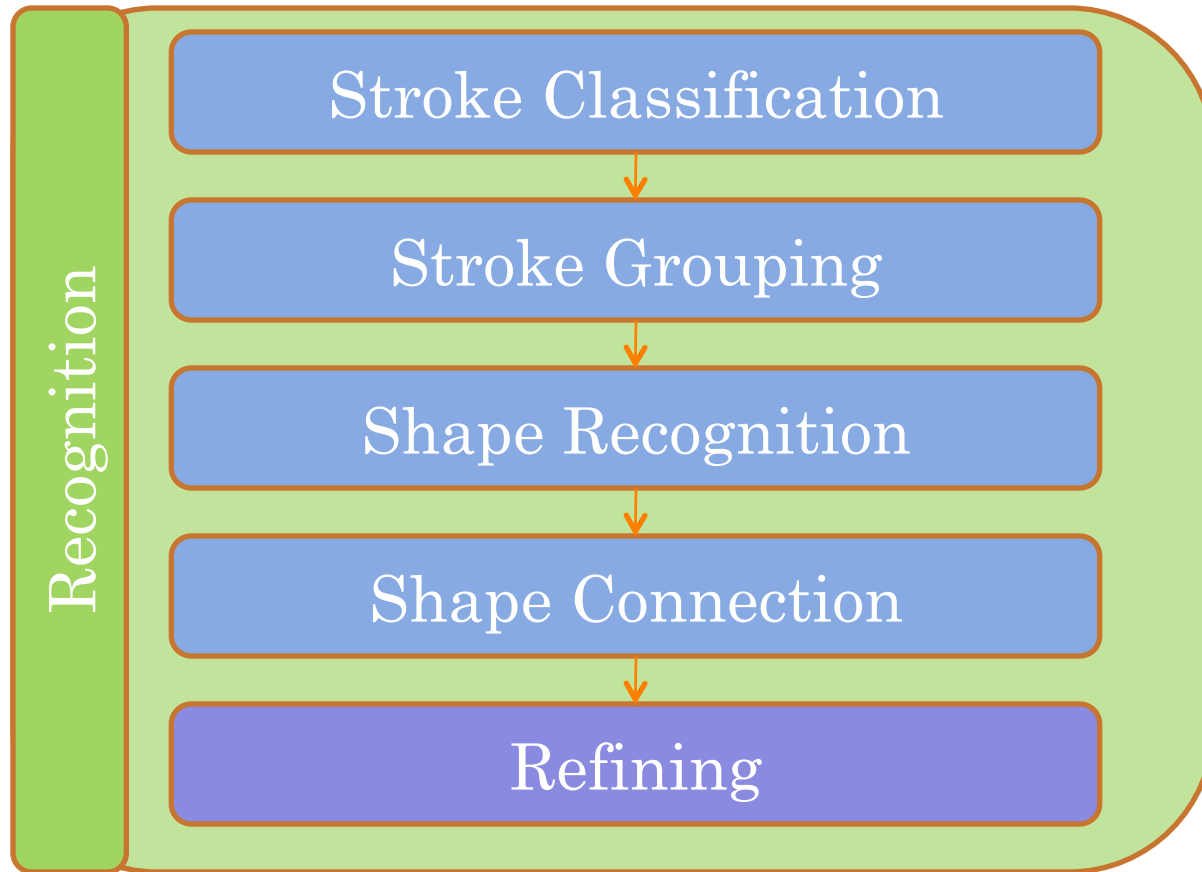
- Rather than storing a set of templates, store a set of features that describe the shape!
- Examples:
 - Area
 - Curvature
 - Pen Speed



ROOM FOR IMPROVEMENT

- Recognition can always be improved.



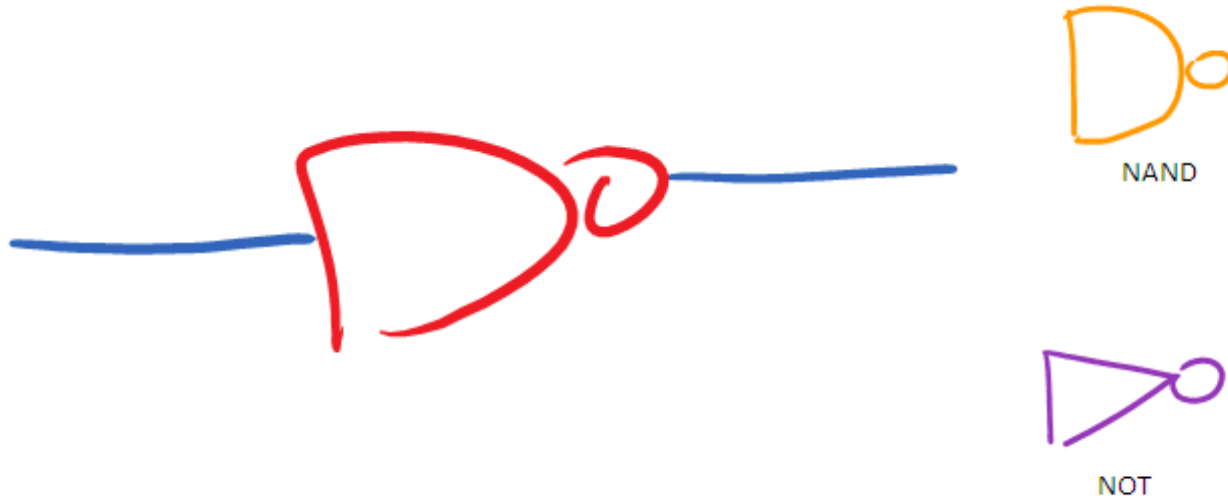


RECOGNITION REFINEMENT

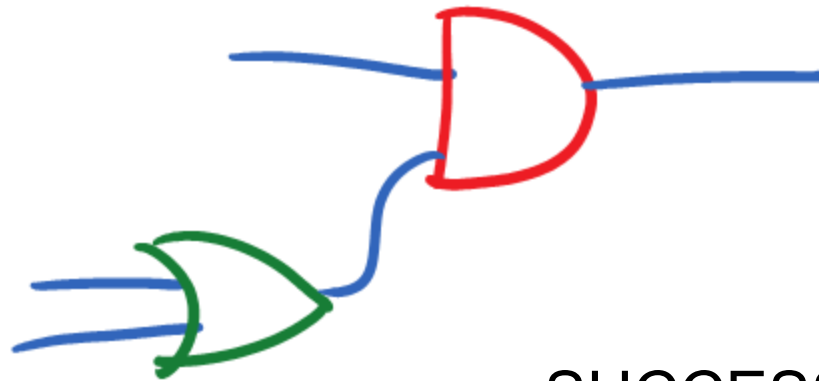
- Context
- Stroke Steal
- Stroke Shed



CONTEXT REFINE



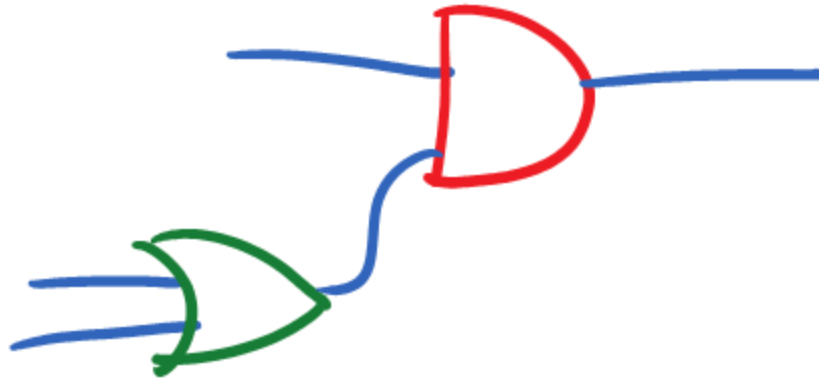
STROKE SHED REFINE



SUCCESS!



STROKE STEAL REFINEMENT

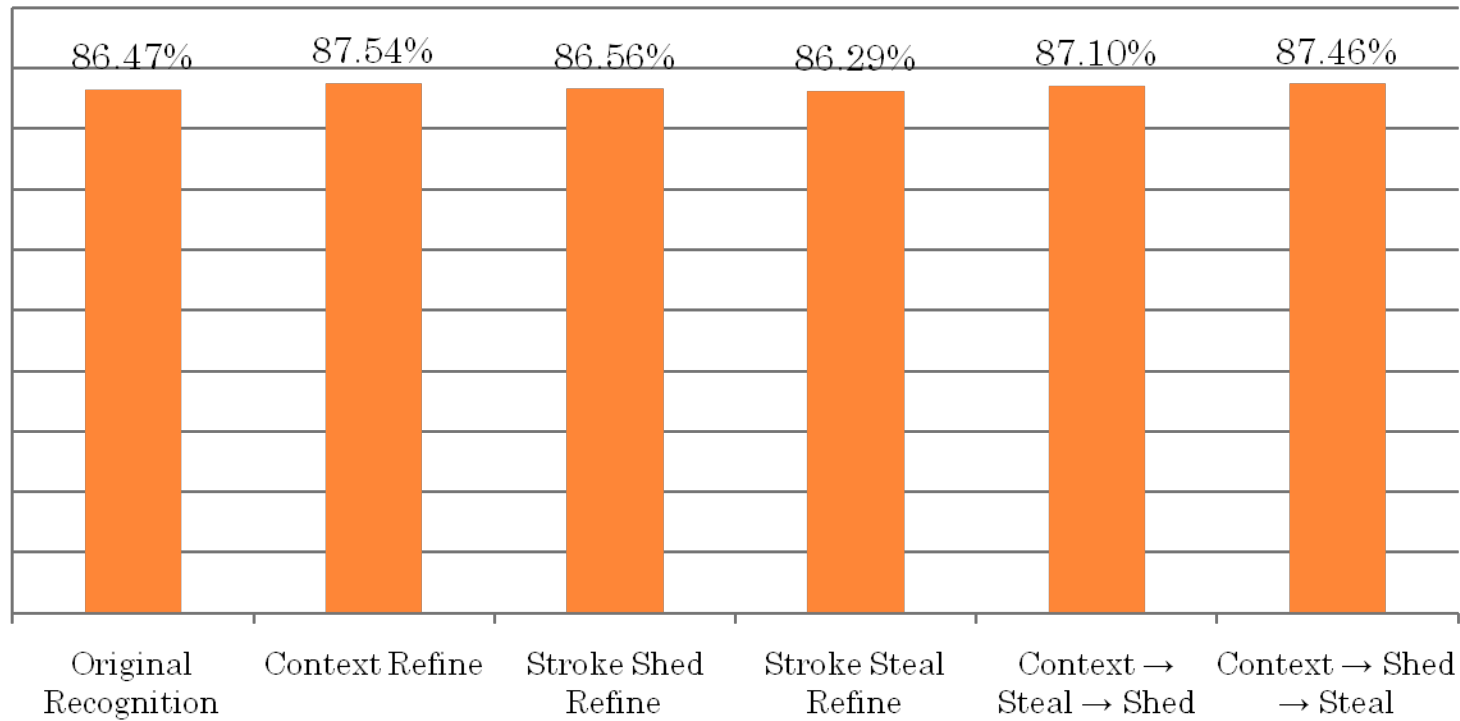


SUCCESS!



REFINEMENT RESULTS

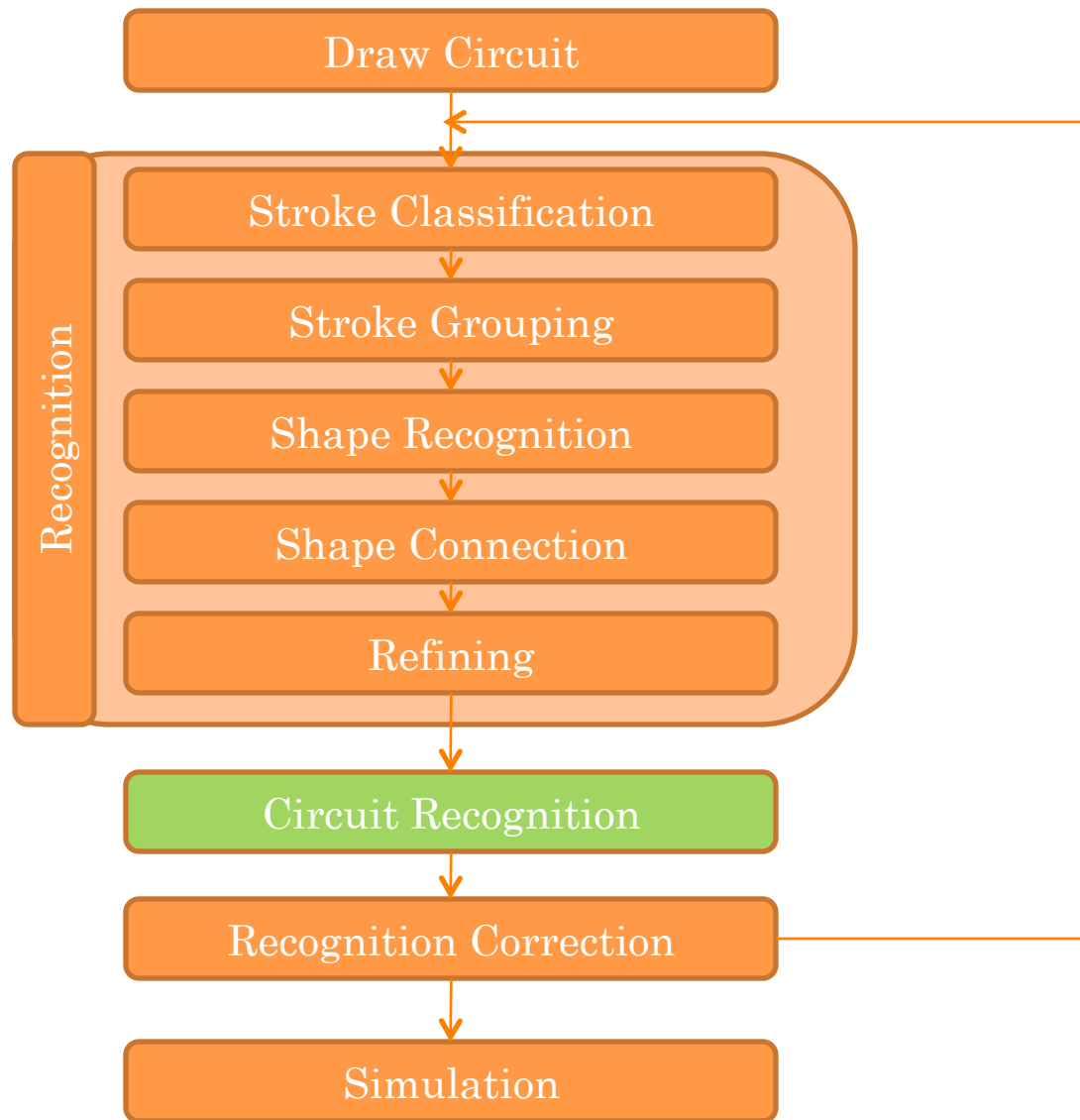
Recognition Accuracy



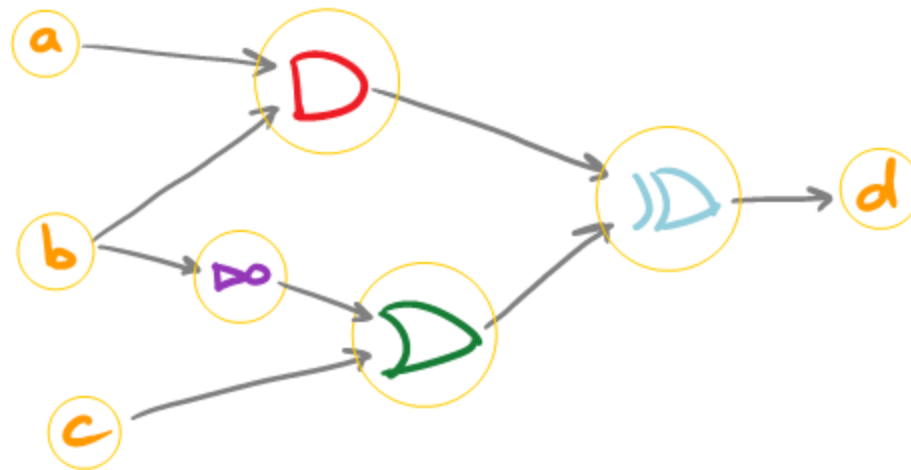
PROBLEMS

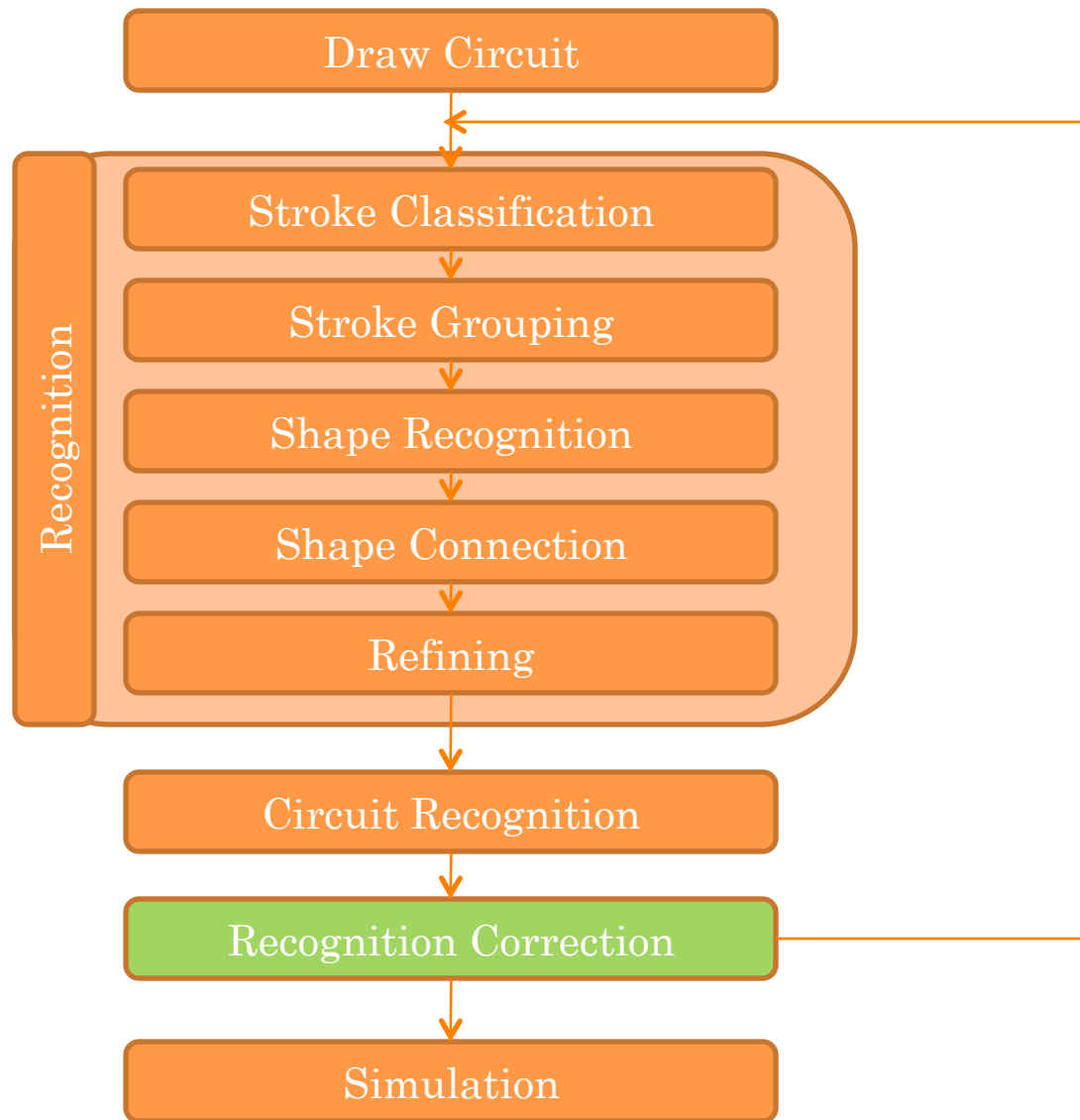
- Hard to tell...
 - When to refine
 - Which refiner to use
 - Whether it refined correctly



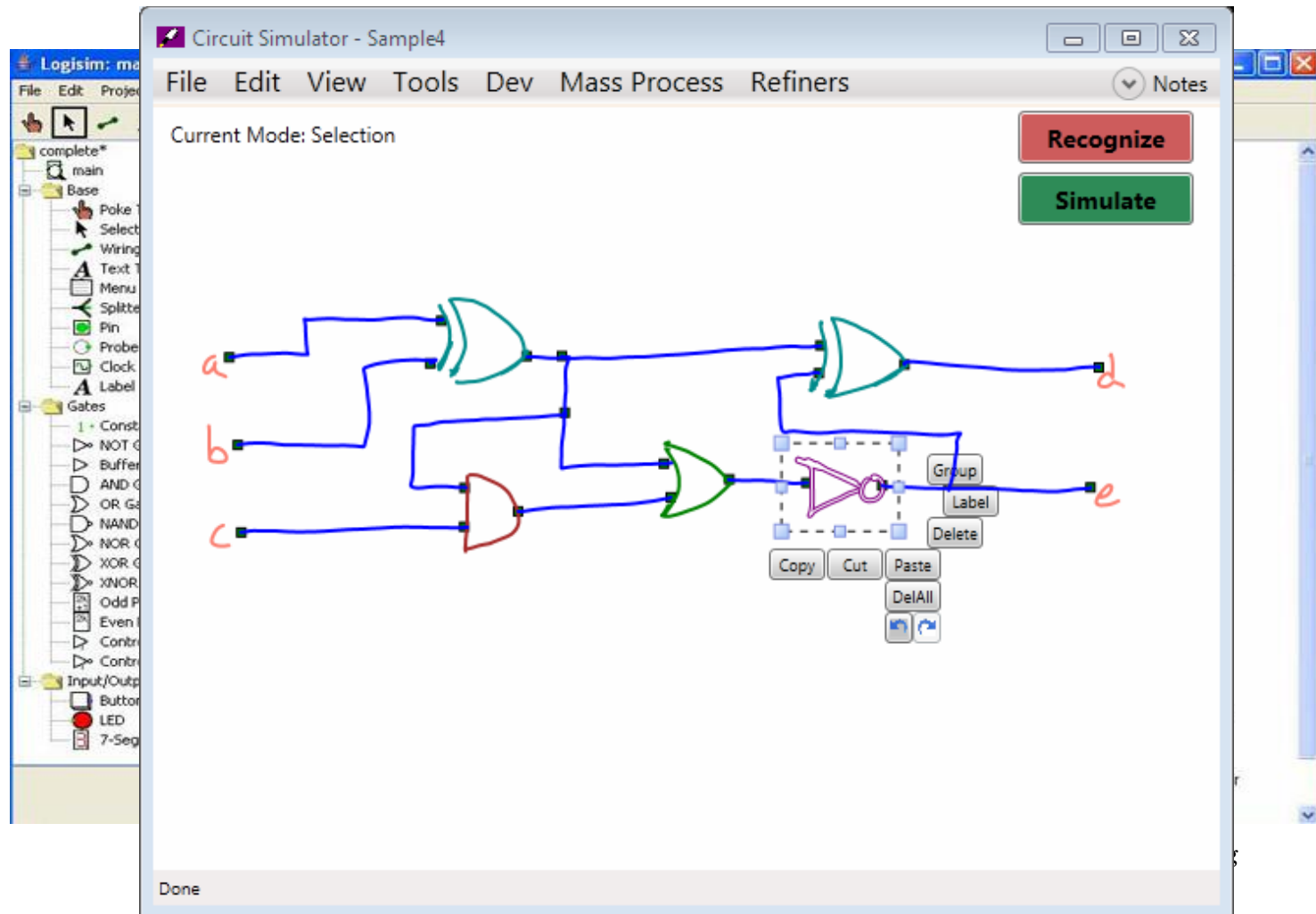


CIRCUIT RECOGNITION



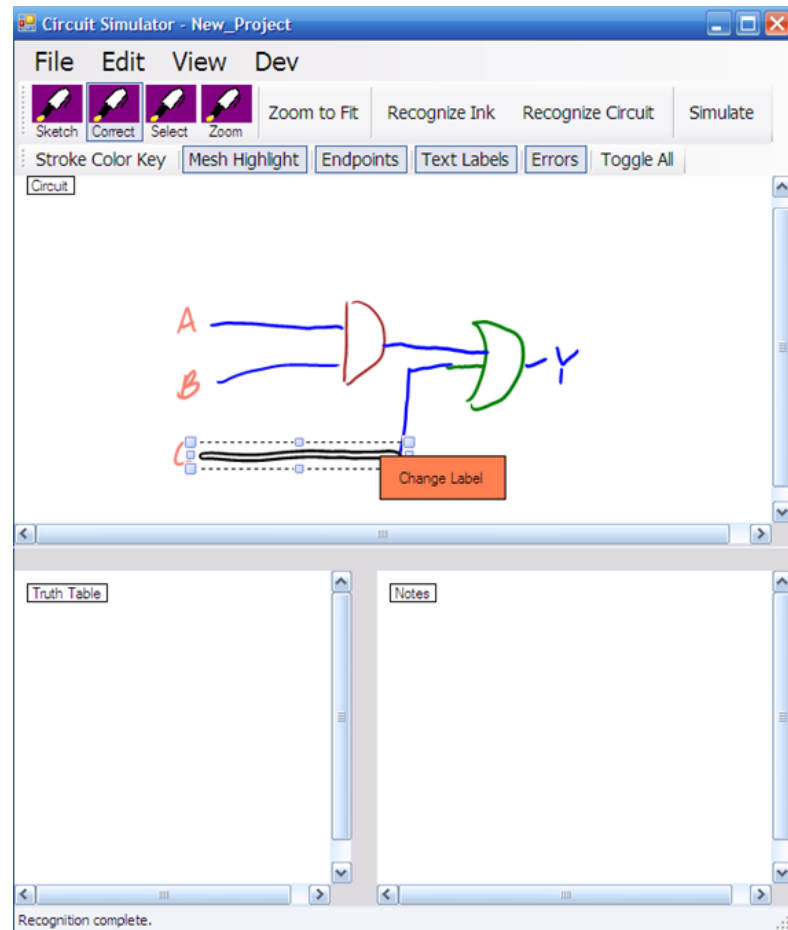


USER INTERFACE



OLD DESIGN – PROBLEMS?

- Modal Interface
- Menus
- Confusing options



2009 Sketchers Presentation



DESIGN GOALS

- “Magic Pen”
- No modes
- Avoid menus and toolbars
- Easy to find and correct errors



HOVER ICONS

- **Hover space** – The space directly above the tablet surface
- Based loosely on Hover Widgets (T. Grossman, et.al., 2006)
- Hold pen above tablet surface, widgets pop up
- Lets stylus be used for selection, correction, editing without a menu or modes



SELECTION

○ Problems

- Often requires a separate mode
- Many types: lasso, drag-box, tapping, others

○ Our solution

- Can begin selection through hover icon or stylus button
- Can draw again after a selection is made
- Users liked drag box with tapping

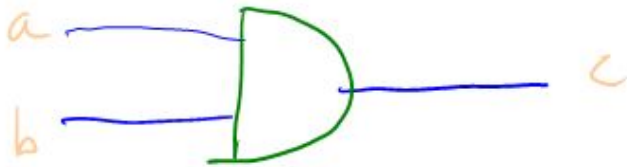


RECOGNITION FEEDBACK & CORRECTION

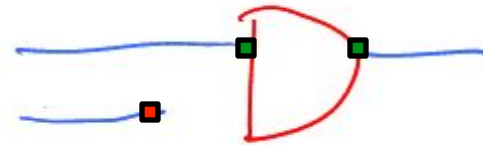
- What is important here?
 - Know if errors exist
 - Easy to correct errors
 - Correcting errors will not introduce more errors



TYPES OF RECOGNITION ERRORS



Incorrect
Labeling



Not
Connected

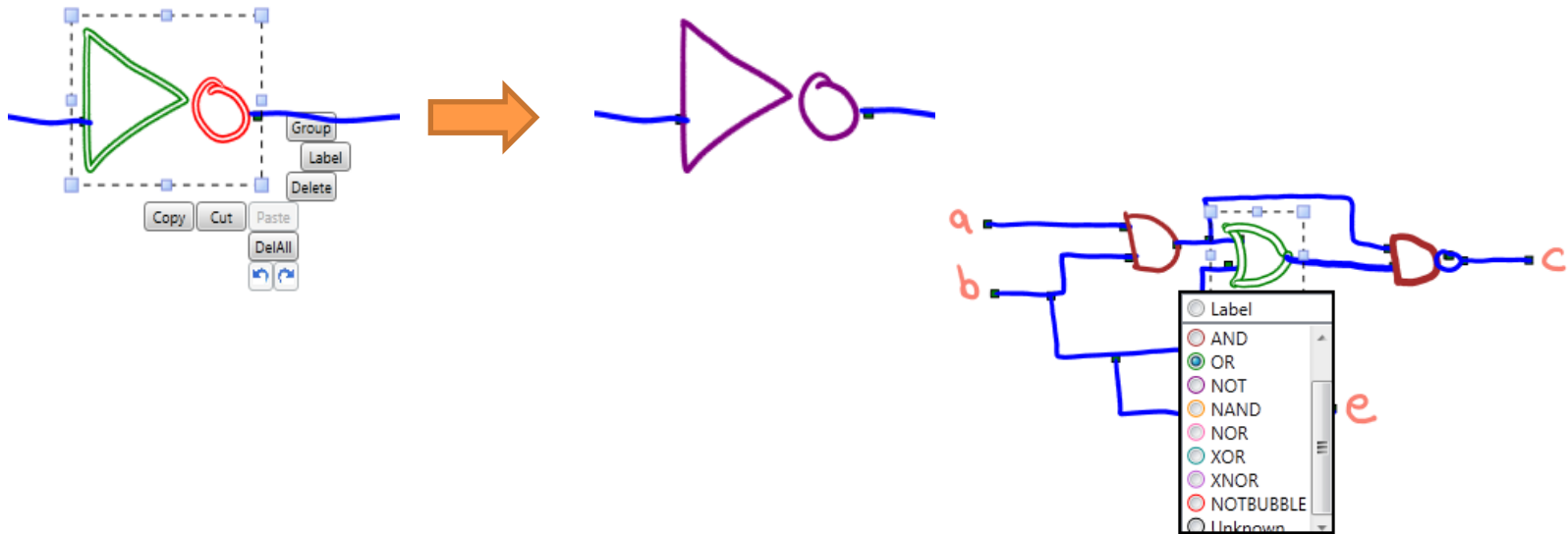


Incorrect
Grouping



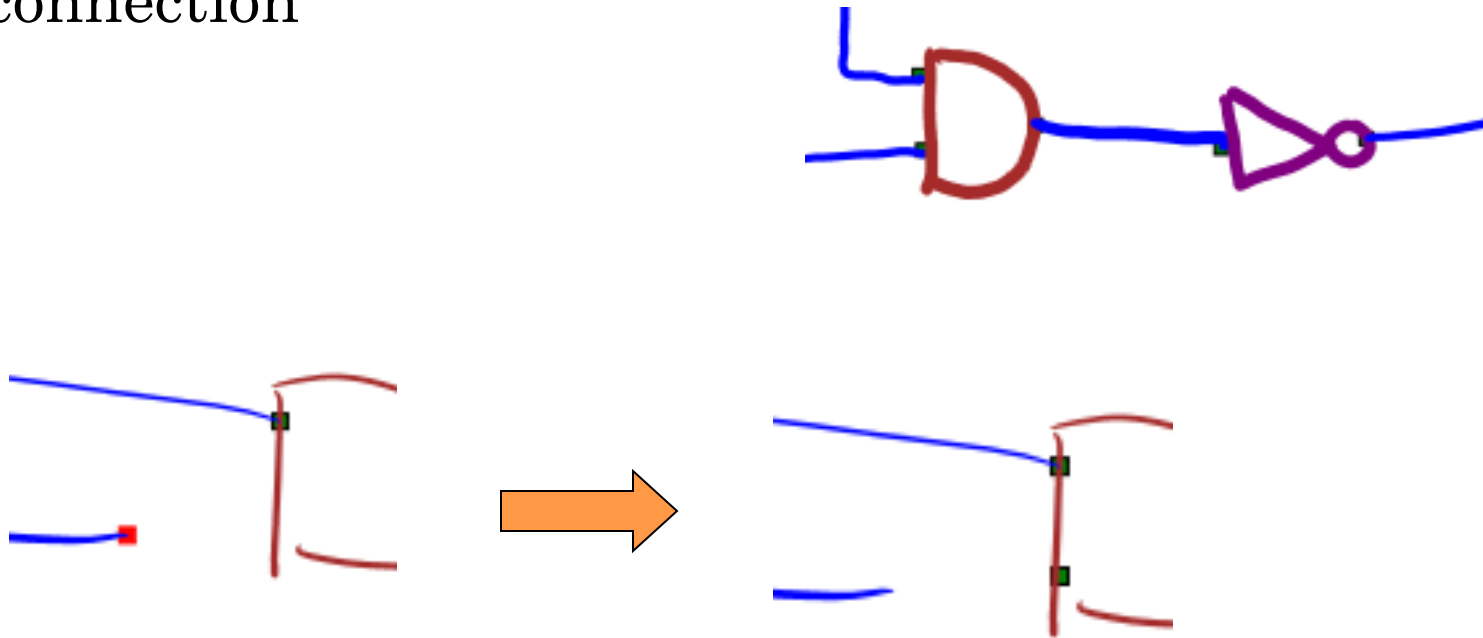
INCORRECT LABELING AND GROUPING

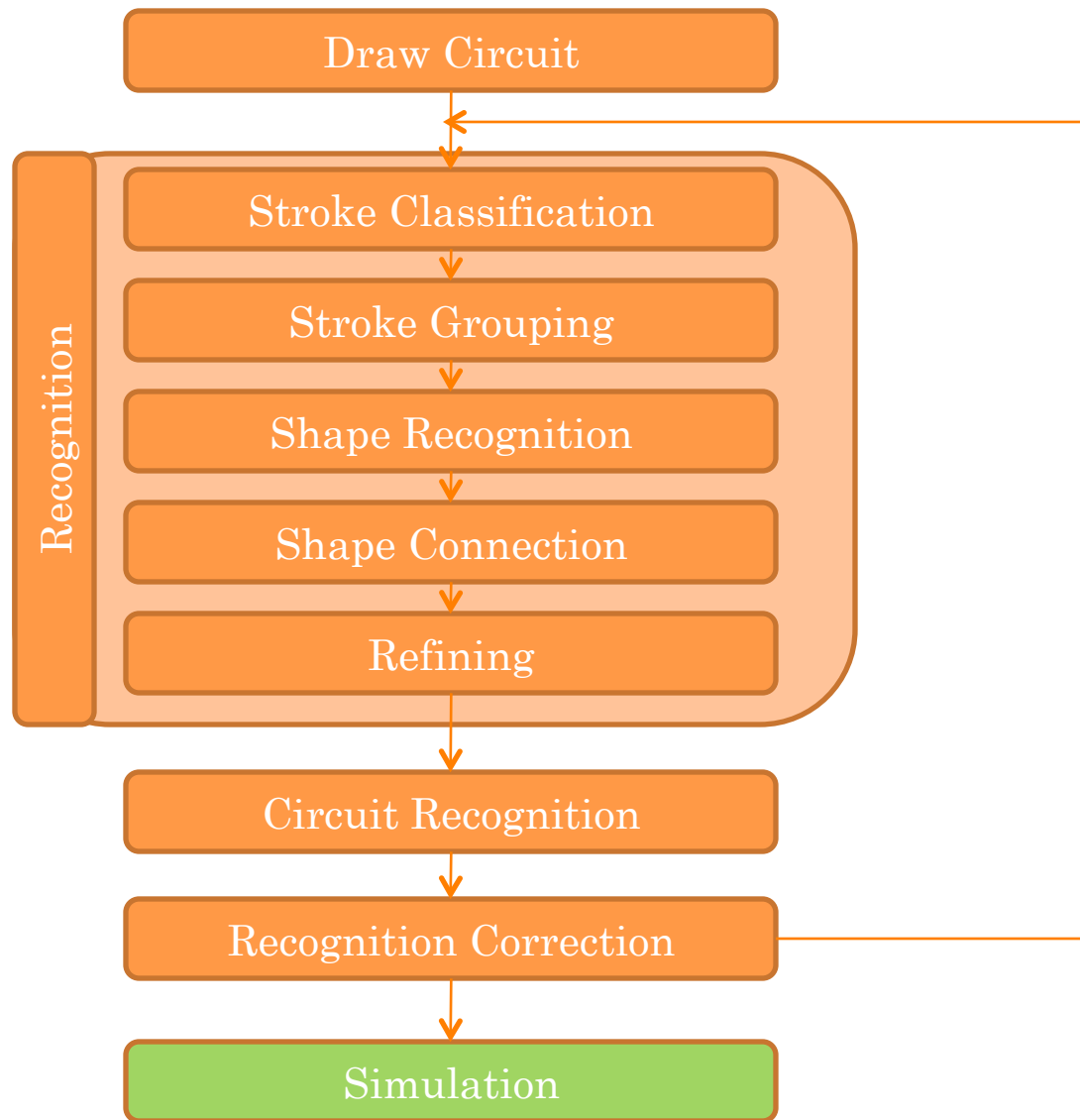
- Identified by stroke coloring and tooltips
- Fixed using relabeling and regrouping
- Shapes connected to changed shape are re-recognized



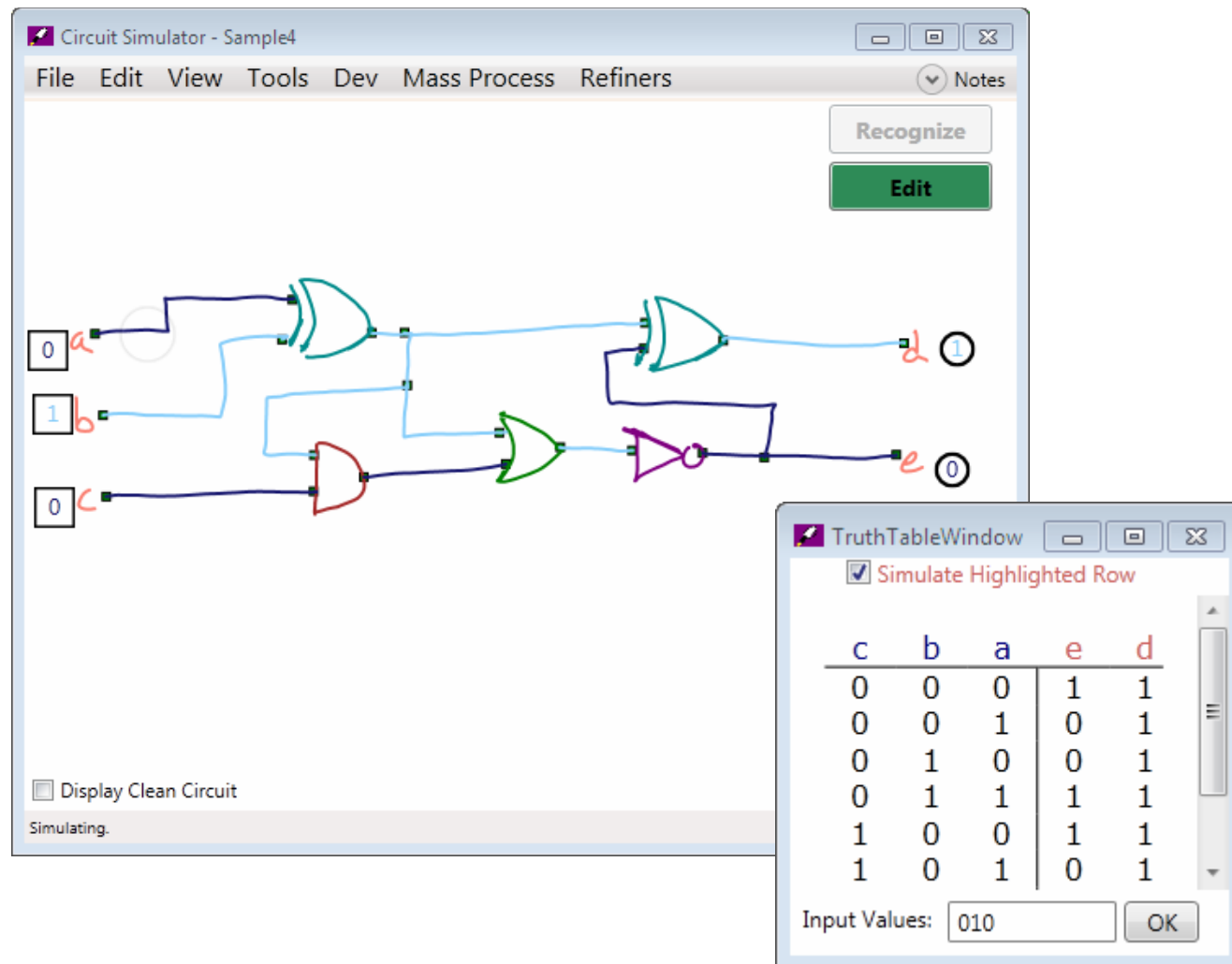
INCORRECT CONNECTIONS

- Identified by mesh highlighting and endpoint highlighting
- Fixed by dragging endpoints, drawing over connection





SIMULATION



DEMO!



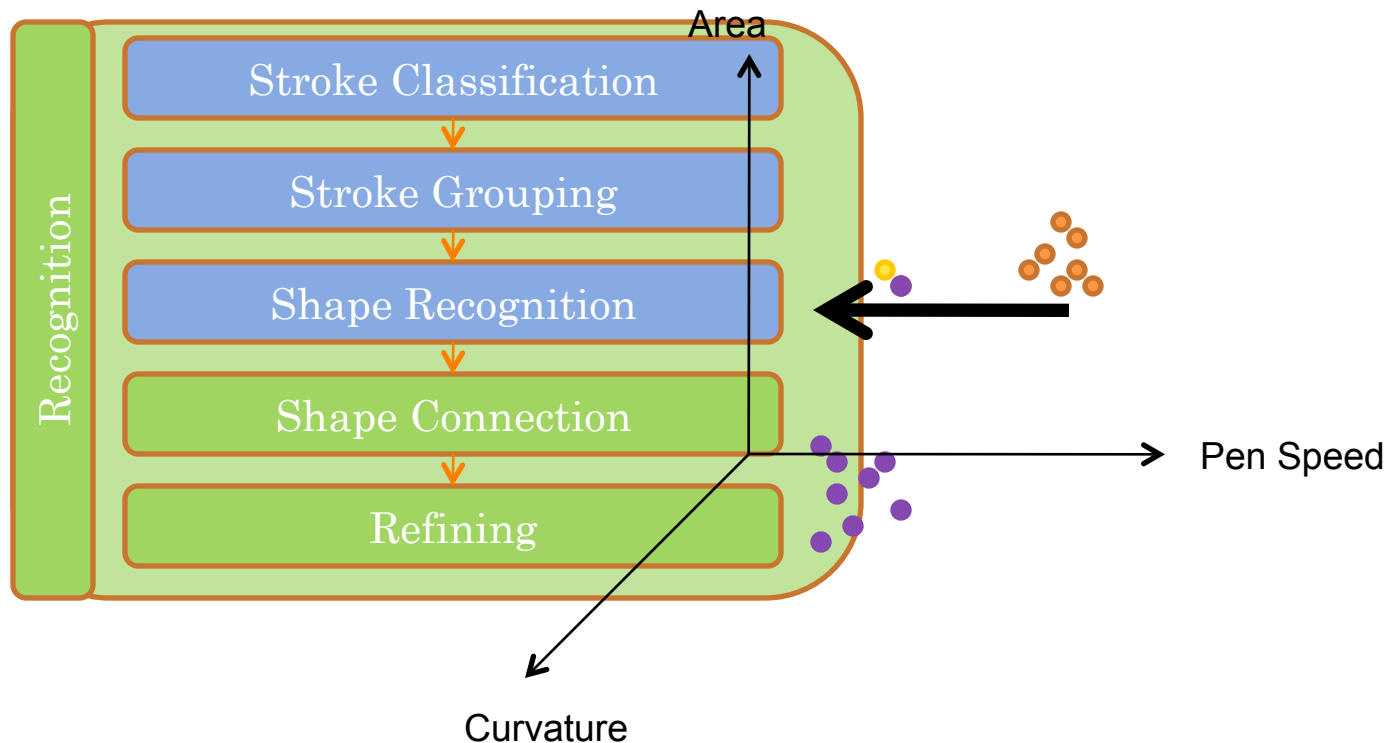
USER PREFERENCES

- Liked using hover icons over menus
- Liked seeing their sketches “come to life”
- Liked using stylus button for selection
- Tended to use re-labeling over grouping
- Would rather erase and re-draw rather than trace over existing strokes to replace them



LEARNING FROM ERROR CORRECTIONS

- How do you use users' corrections to improve recognition?



FUTURE WORK

- Learning from error corrections
- In-depth user studies
- CS 5 or CS 42



QUESTIONS?

