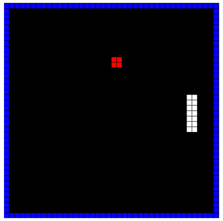
Learning Games by Demonstration

Rahul Banerjee

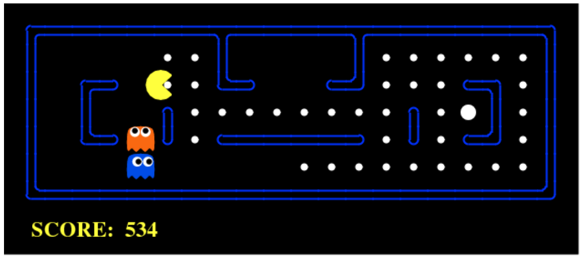
Brandon Holt

CSE 573 – Au 2012

Motivation



- Build simple 2D games without writing a single line of code.
- Programming by demonstration
  - Users demonstrate how objects behave
  - System infers the game logic
    - Use knowledge of how 2D games work
    - Emphasize more general solutions
  - User refines behaviors with more examples



Related Work

- **Programming by Demonstration Using Version Space Algebra.** T. Lau, S. A. Wolfman, P. Domingos, D. S. Weld. *(Machine Learning, 2003)*
  - SMARTedit (repetitive text-editing tasks)
- **Spreadsheet Data Manipulation Using Examples**. S. Gulwani, W. R. Harris, R. Singh. *(CACM 2012, POPL 2011, PLDI 2011)*
  - (excel macros)
- **Synthesizing Geometry Construction.** S. Gulwani, V. A. Korthikanti, A. Tiwari. *(PLDI 2011)*
  - (drawing tool)
- (and many more…)

Learning Games

Implicit Game Loop:

```
while (True):
  T = detectTriggers(gameState)
  for (trigger,objs) in T:
    action = actionsTable[trigger]
    action(objs)
```

actionsTable:

keypress<UP_KEY>	move(paddle, 0, 1)
init<Ball>	repeat(move(ball, 1, 1))
collision<Ball, Paddle>	bounce(ball, X)
collision<Ball, Wall>	bounce(ball, collision.direction)
…	…

GameObject

- Wall
- Ball
- Paddle
- …

Trigger

- init<obj>
- keypress<key>
- collision<obj1,obj2>
- …

Action

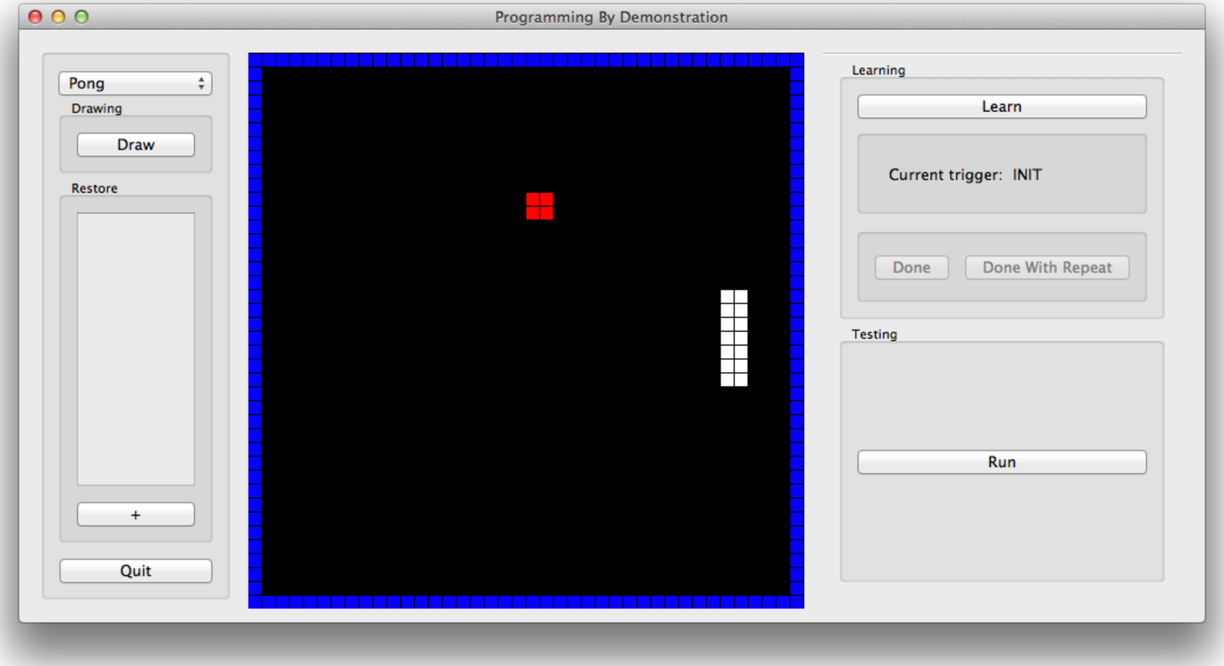
- replace
- bounce
- stop
- repeat
- delete
- …

Implementation/Evaluation

- Simple prototype
  - Written in Python, ugly Qt GUI
  - Objects/movements constrained to tiles
  - Learning by “demand-paging”
- Evaluation
  - Metric: number of demonstrations needed to learn game
  - Plan to evaluate on Pong, Pacman, and some other game

Demonstration

(no pun intended)



Current trigger: INIT

Future Work

- World builder
  - Actually make your own game
  - Allow object spawning as Action
- Continuous space
  - Smoothing
- Timeline scrubbing
  - Rewind and demonstrate what “should have happened”
- Physics
  - Enable “platformer” with gravity
  - Pick most “physically accurate”