DejaVu: Integrated Support for Developing Interactive Camera-based Programs

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BACKGROUND

Camera-based programs are getting popular with affordable hardware and useful software libraries.
PROBLEMS

Various visual data
Continuous processing
Non-reproducible input
PROBLEMS

Various visual data
- Camera input
- Intermediate results
- Window output...

Current IDEs:
- Textual value only
PROBLEMS

Continuous processing

- Frame-by-frame nature
- Temporal visualization desired

Current IDEs:

- Breakpoint is problematic
- Custom visualization needed
PROBLEMS

Non-reproducible input

- Iterative test process
- Same action impossible
- Environmental noise

Current IDEs:

- Just go back and forth between the camera and the PC…
CONTRIBUTION

Enhancement to an IDE for general development of the interactive camera-based program.
RELATED WORK: PROTOTYPING TOOLS

**Exemplar, RePlay**: record & replay of sensor input

[Hartmann et al., CHI’07]
[Newman et al., UIST’10]

**Crayon, Eyepatch**: external tools for computer vision

[Fails et al., CHI’03]
[Maynes et al., UIST’07]
RELATED WORK:
GESTALT

Programming for machine learning [Patel et al., UIST’10]
DEJAVU INTERFACE
DEJAVU INTERFACE: CANVAS

- Visualizing *various visual data*
- Showing *continuous processing* results
- Sketching capability
DEJAVU INTERFACE: TIMELINE

- Recording & replaying to handle non-reproducible input
- Synchronized with canvas
DEMONSTRATION

KinectDress: virtual dressing room application

Go close to start
Move to try-on
Swipe to change clothing
IMPLEMENTATION

Extension to SharpDevelop IDE

Thin-wrapper of Kinect for Windows SDK

Silently inserting code to track variables

Example) Original: double a = func();
Rewritten: double a = (Double)(IDE.track(func(), 17));
CONCLUSION

- **DejaVu** provides enhanced **integrated support** for interactive camera-based programs.
  - **Canvas**: visualization of current situation + sketch
  - **Timeline**: visualization in temporal fashion + replay
- We received positive feedback from target users.
APPENDIX
EXECUTION MODES

Live execution
Replay
Refresh
EXECUTION MODES

Live execution
Replay
Refresh

Recorded session
Recorded input
Variable contents
Output

Live input
DejaVu API
User program

1720
furthestDepth
segmentationMask
Window output
EXECUTION MODES

Live execution
Replay
Refresh
EXECUTION MODES

- Live execution
- Replay
- Refresh

Diagram:
- Recorded session
  - Recorded input
  - Variable contents
  - Output

- Live input
  - DejaVu API
  - User program
  - Window output

1720 (furtherDepth, segmentationMask)
EXECUTION MODES

Live execution
Replay
Refresh

Recorded session

Recorded input
Variable contents
Output

DejaVu API
User program

Live input

1720

FurthestDepth
SegmentationMask

Window output
USER FEEDBACK

3 experienced programmers
1 hour trial + informal interview

Positive comments and suggestions

• Simulating and manipulating input
• Visualizing generic arrays
• Composite visualization
EXAMPLE APPLICATION (KINECTDRESS)

Go close to start

Swipe to change clothes

Move to see fitting

Camera captures frame

Process frame data

Distance between user and camera < threshold $D_t$

Yes

Segment user’s image based on depth data

Based on the most recent $n$ frames, recognize whether there is a swipe gesture?

Yes

Switch to next virtual suit in the list

Update virtual suit’s position and size

Render application graphics

No

No