Real-Time Note Digitizer!

– ECE532 Team A\/\/350/\/\3!–

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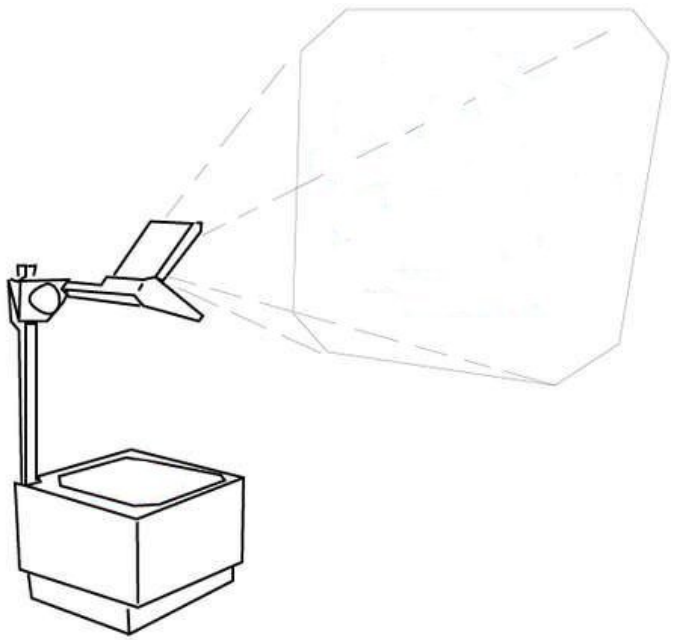
We've all been in class...

- Projectors and tablets used for delivering notes
- Hard to record content, lots of wasted data or no effective way of replaying!



Goal

Easy to record notes

Efficient storage

Without loss of written content

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Initial system for real-time performance

- High-performance, real-time video processing
- Entirely in hardware

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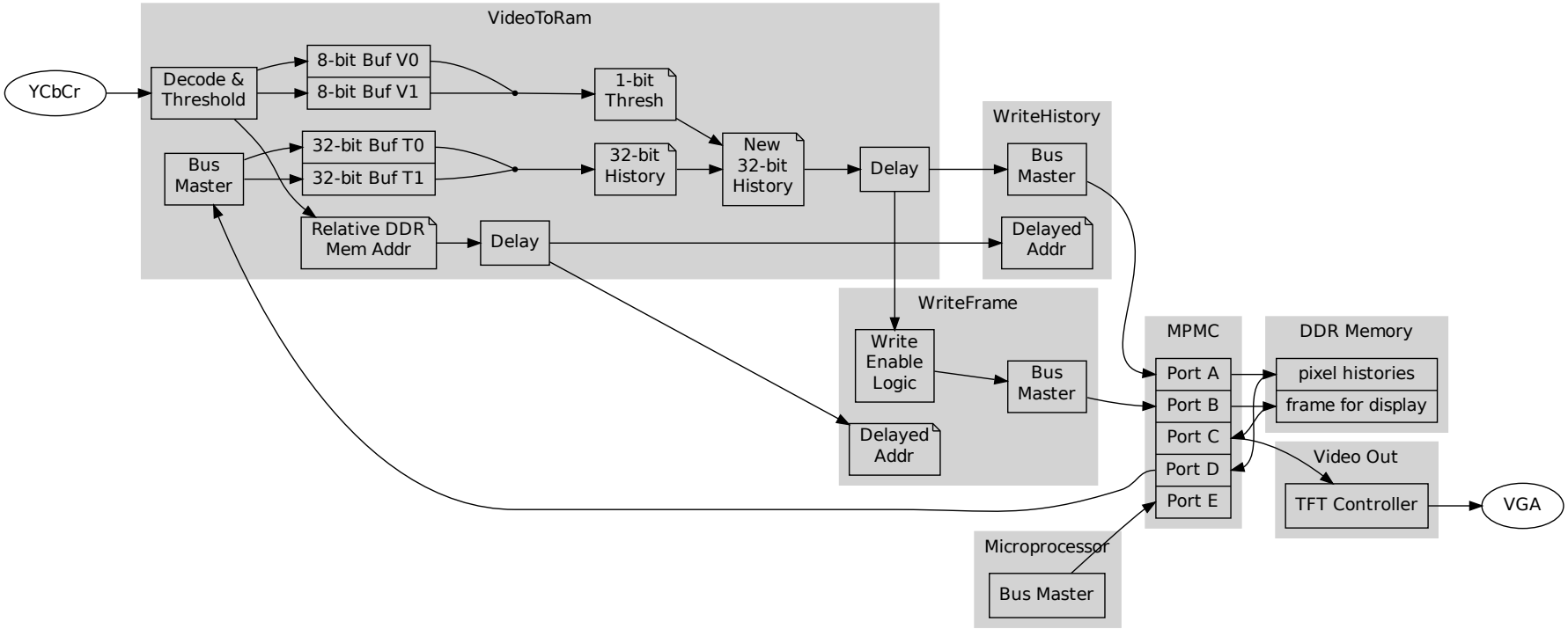
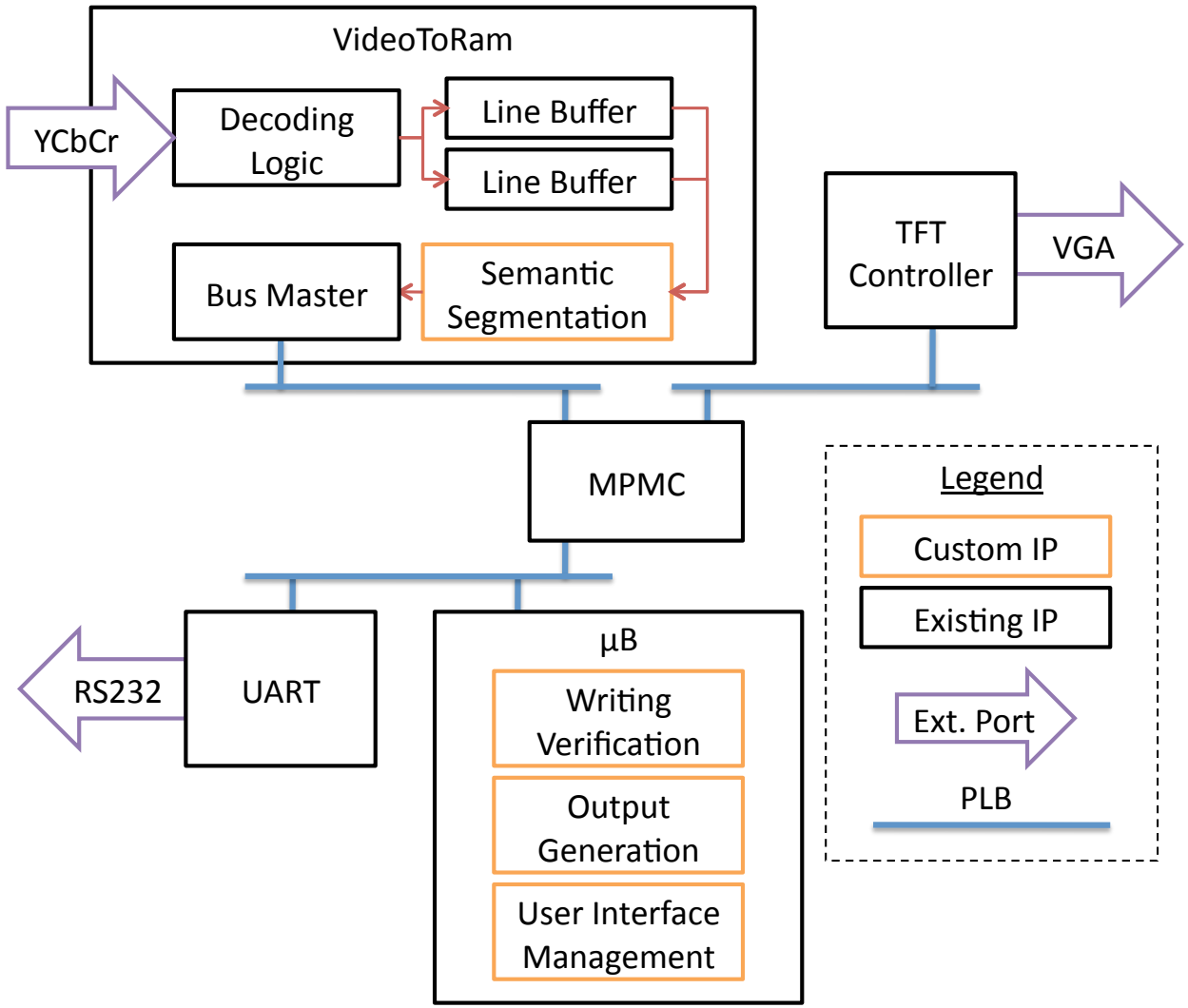


Revised System



Revised System

Analog

Decoder

YCbCr

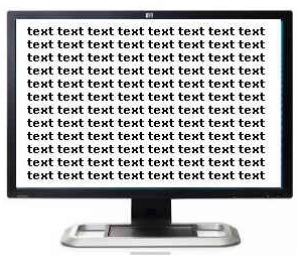
Semantic Segmentation

To Processor

Pixel History

Generate Output

VGA



Qualitative Approach

Given an input image, would like to classify each pixel:

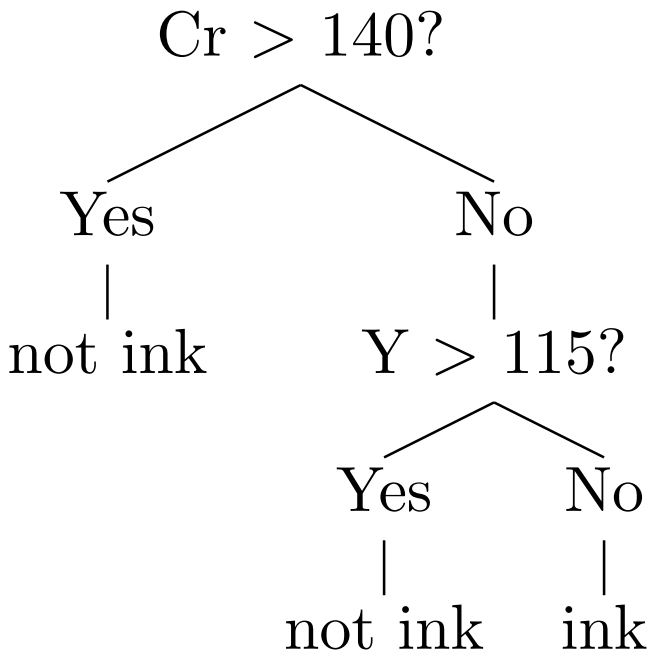
Ink

Not Ink

Decision Tree Classifier

1. Paper and ink alone is easy
2. YCbCr is decorelated
3. Human skin profile

Build decision tree to classify!



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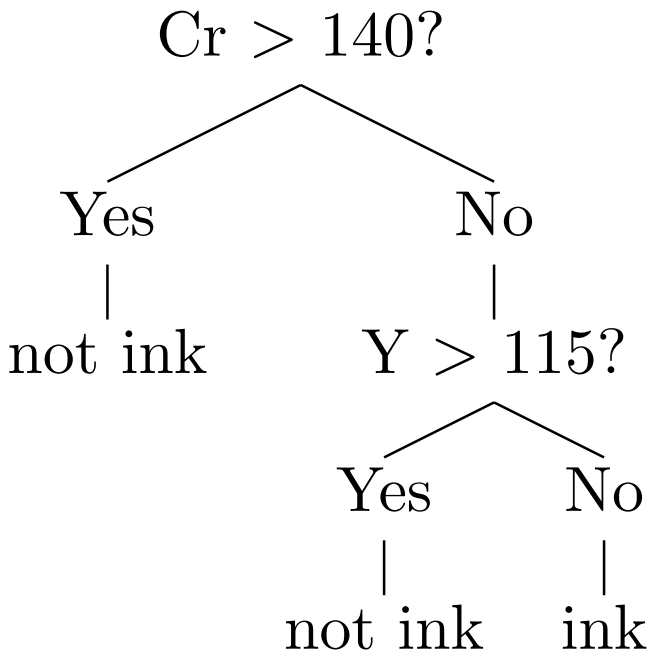
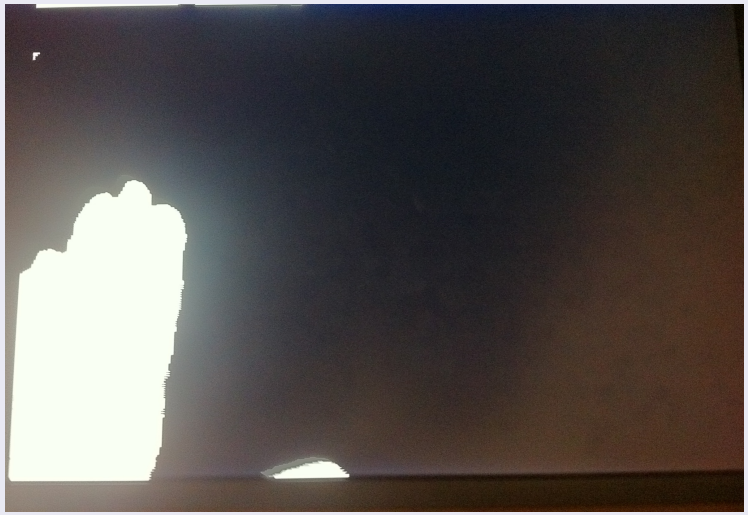


Calibration

Base Image

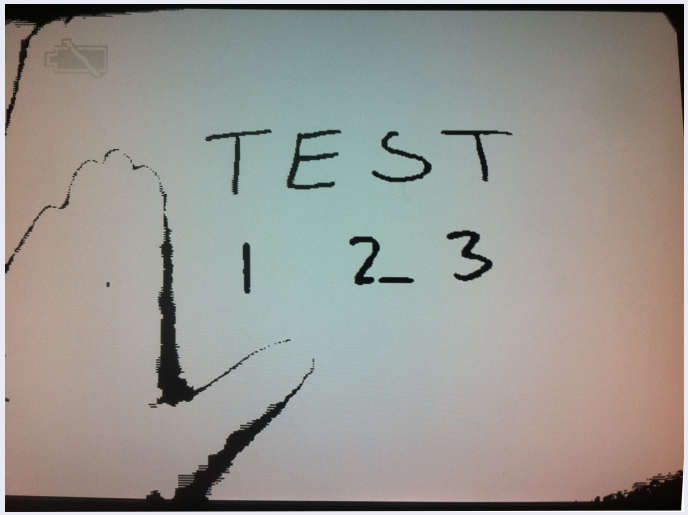
Cr segmentation



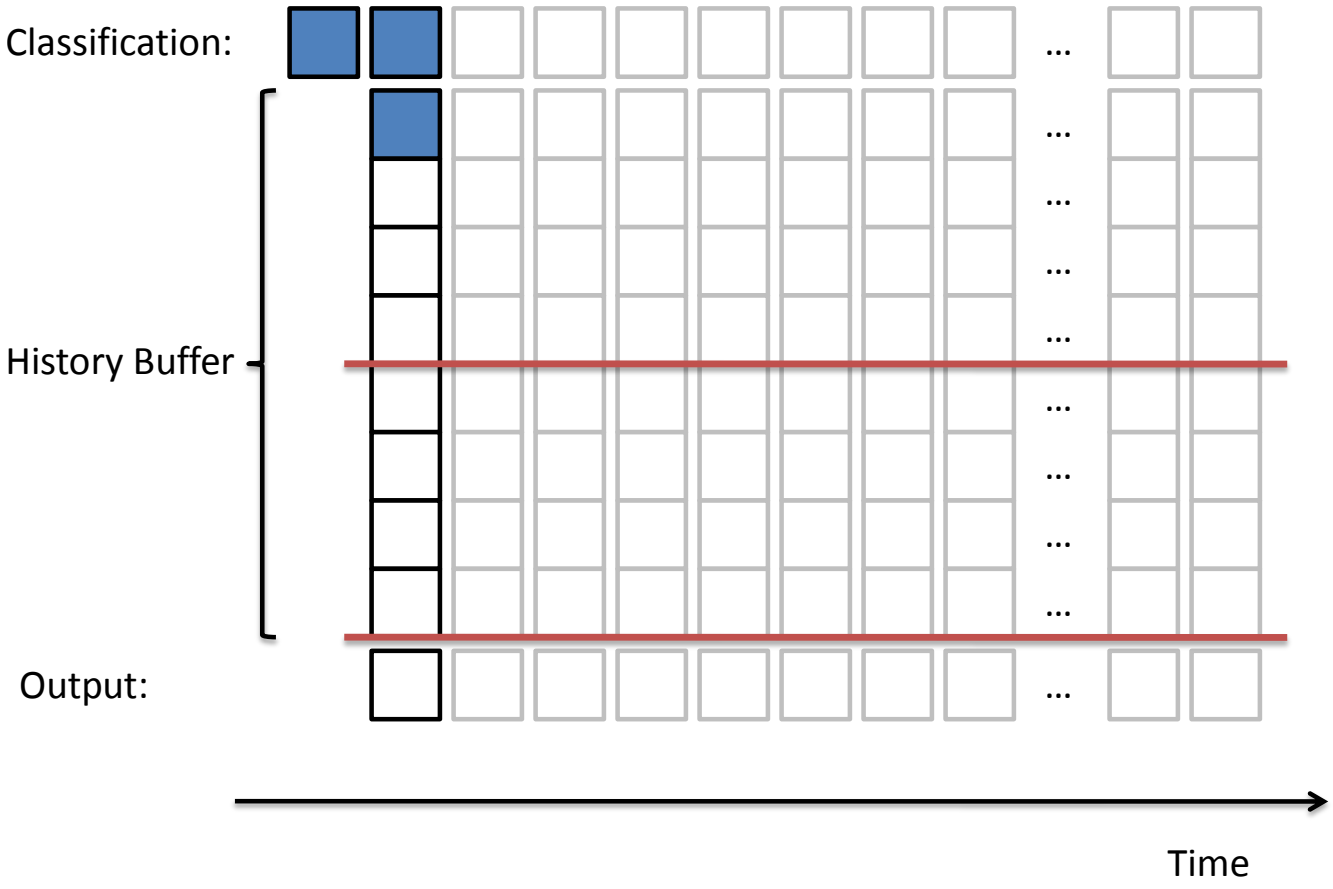
Calibration

Base Image

Y Segmentation



Pixel History



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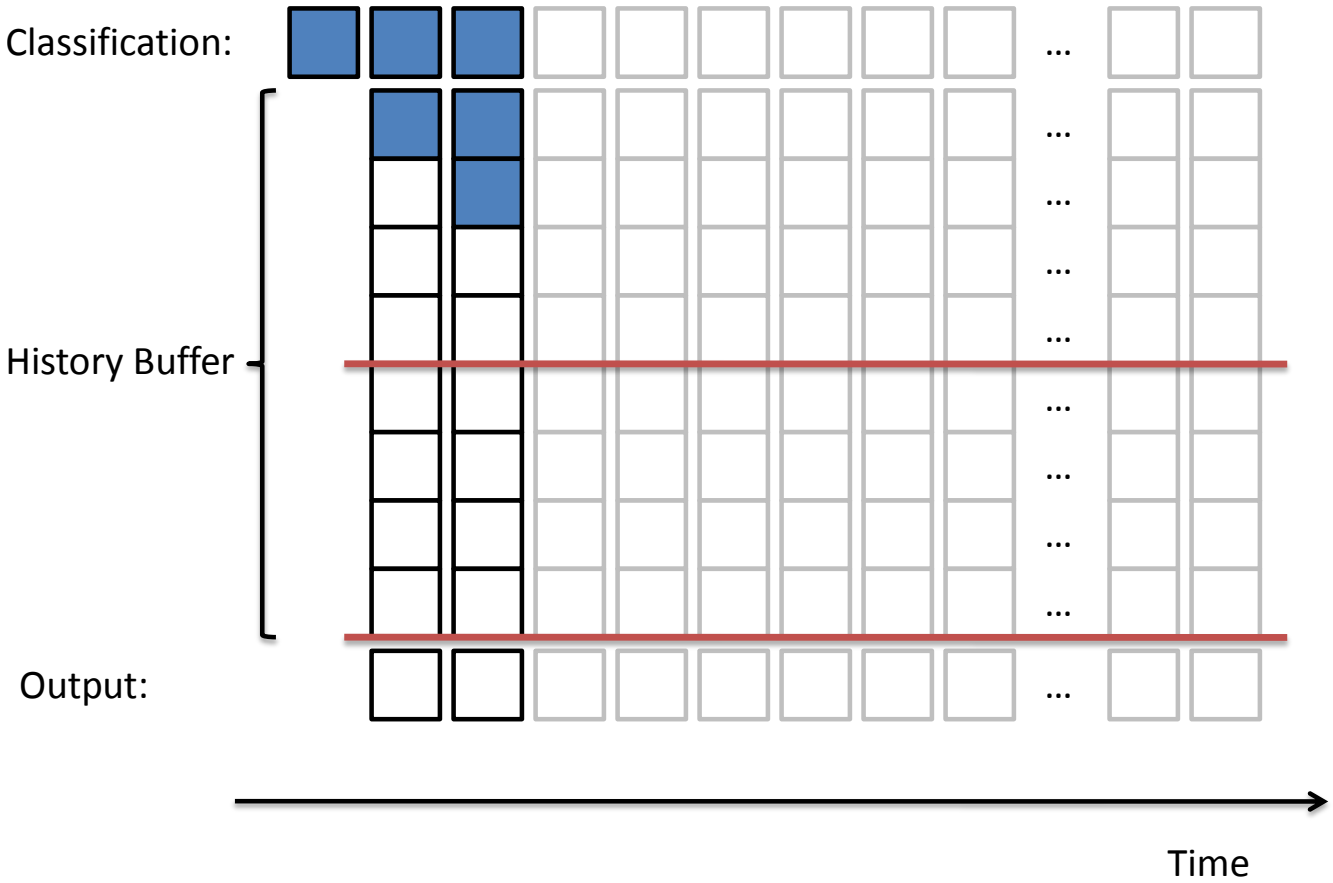

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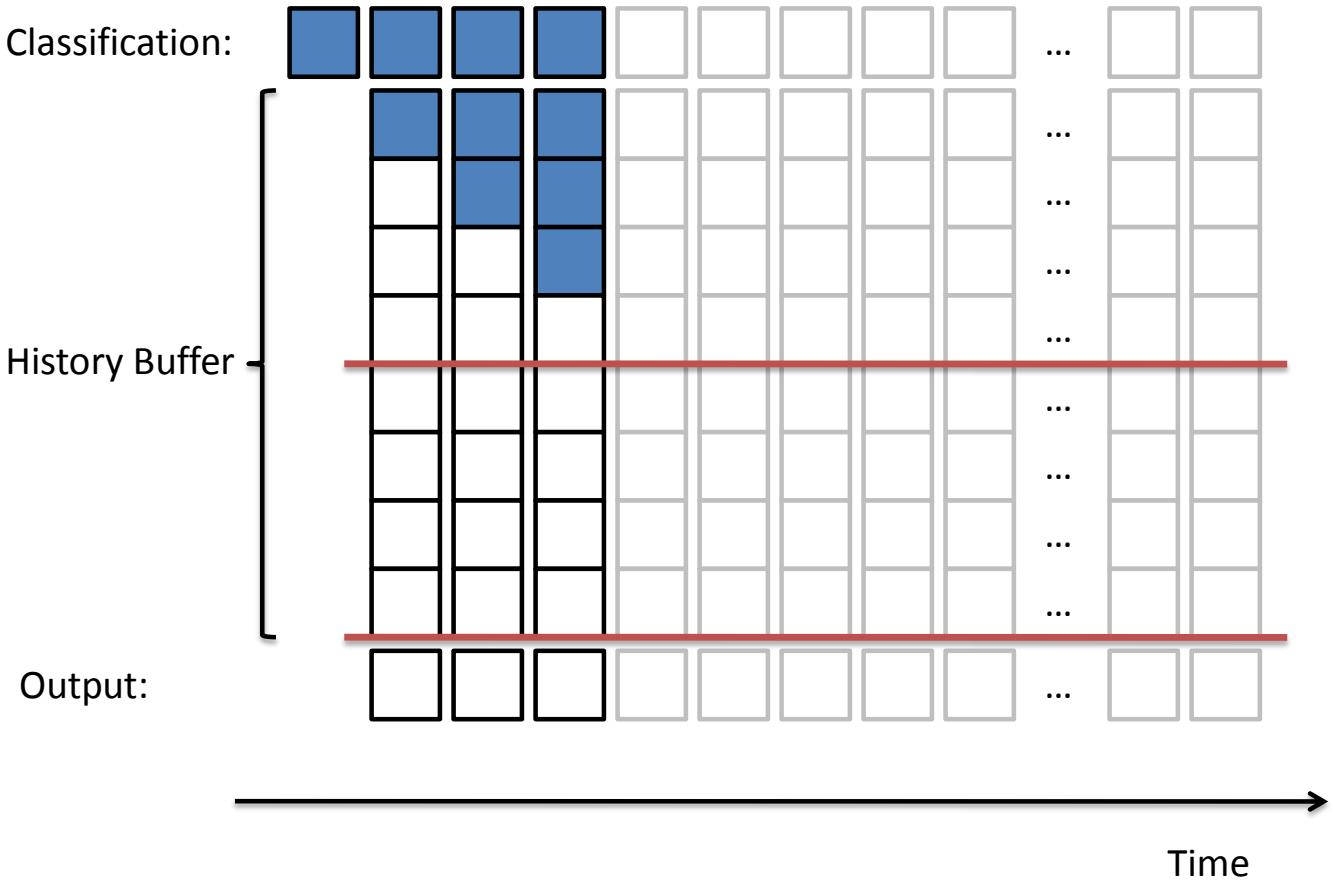

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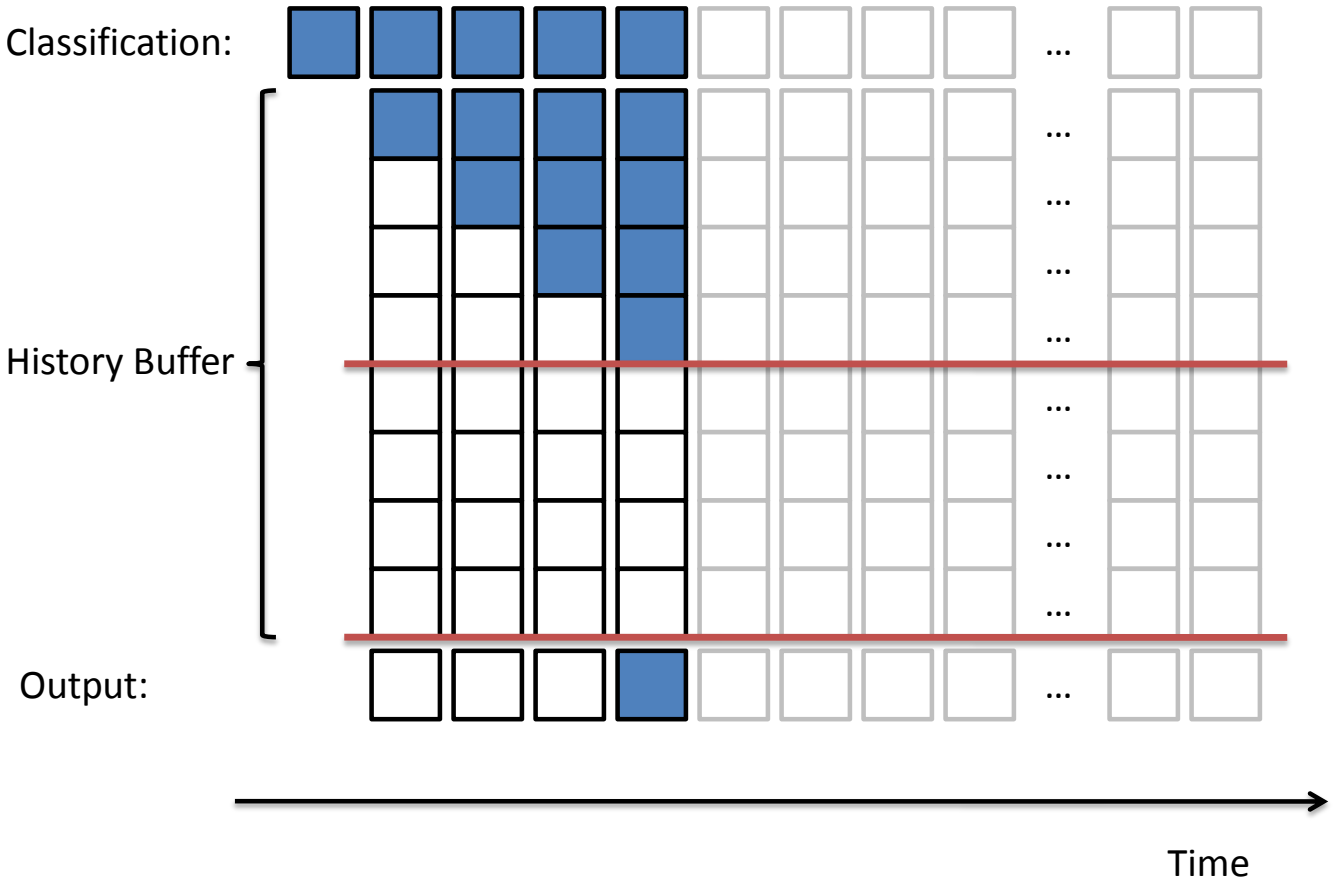

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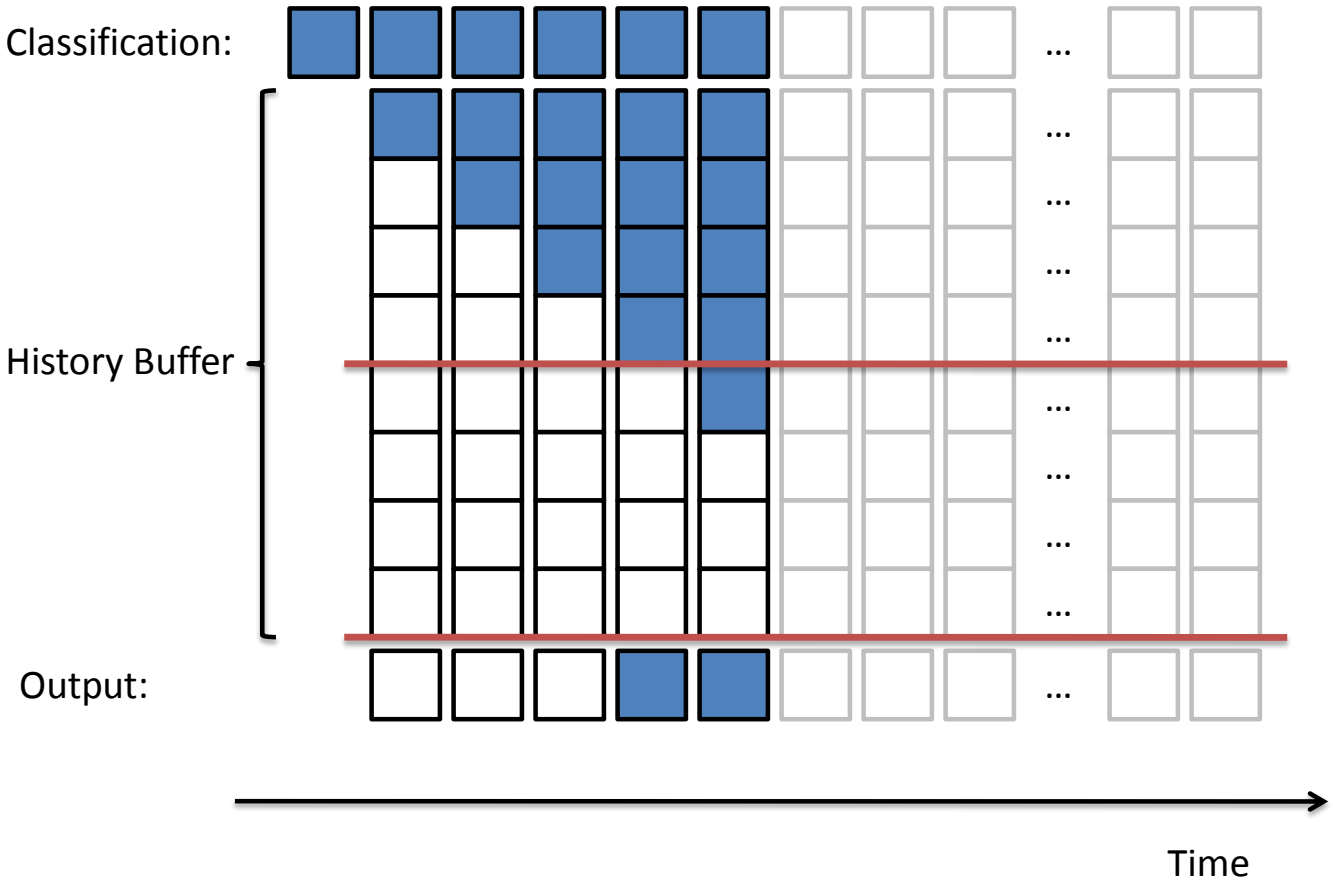
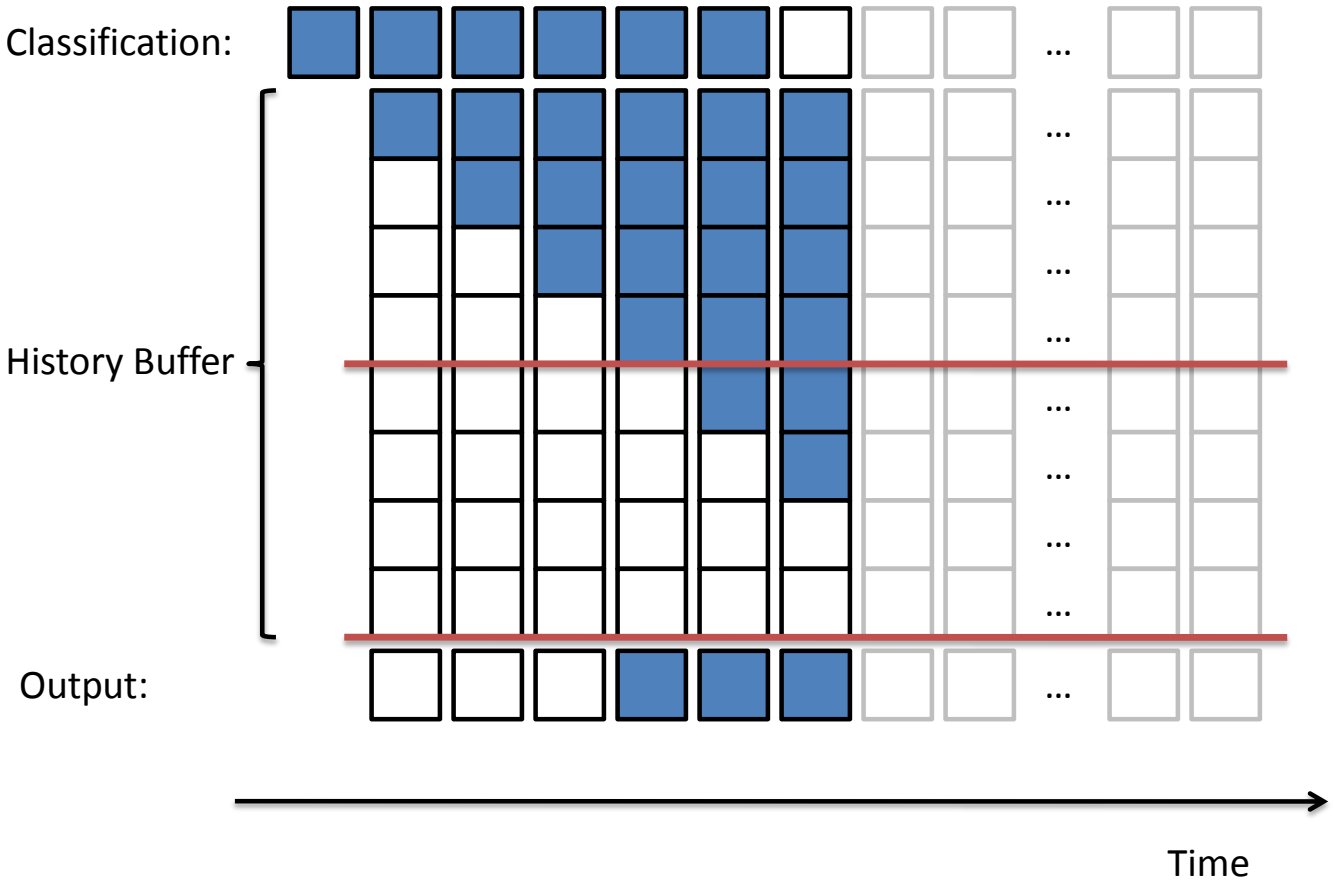


Pixel History



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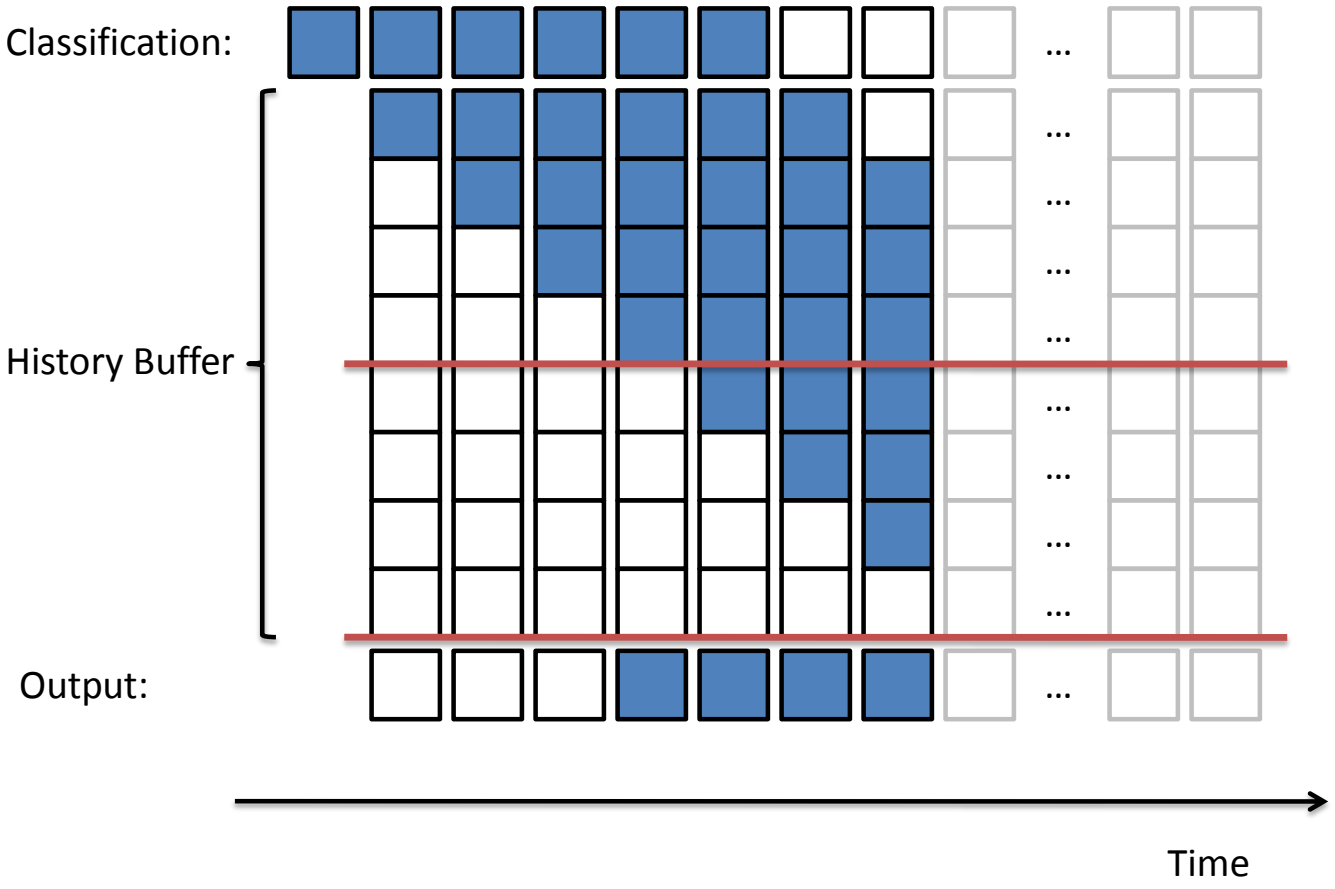

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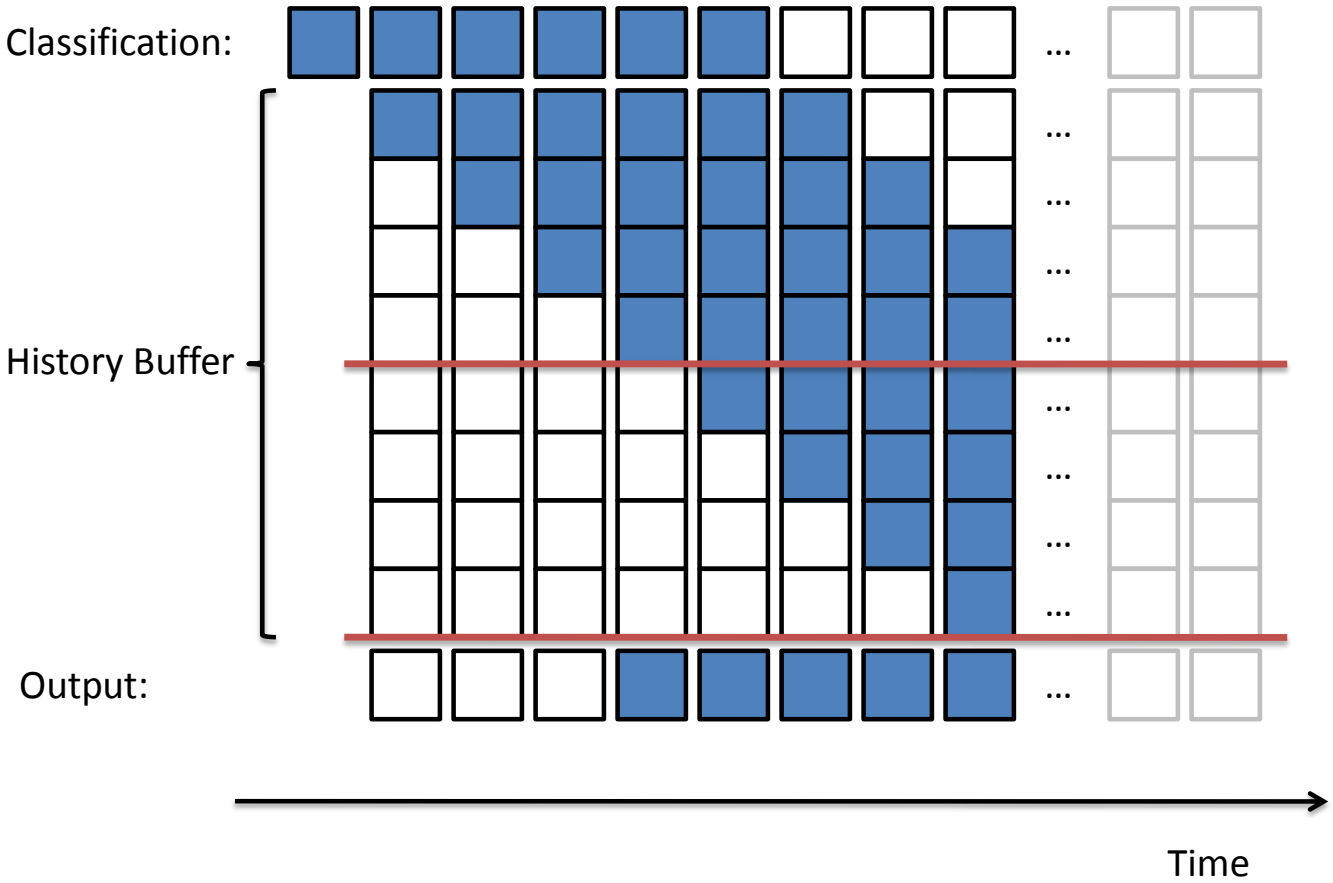

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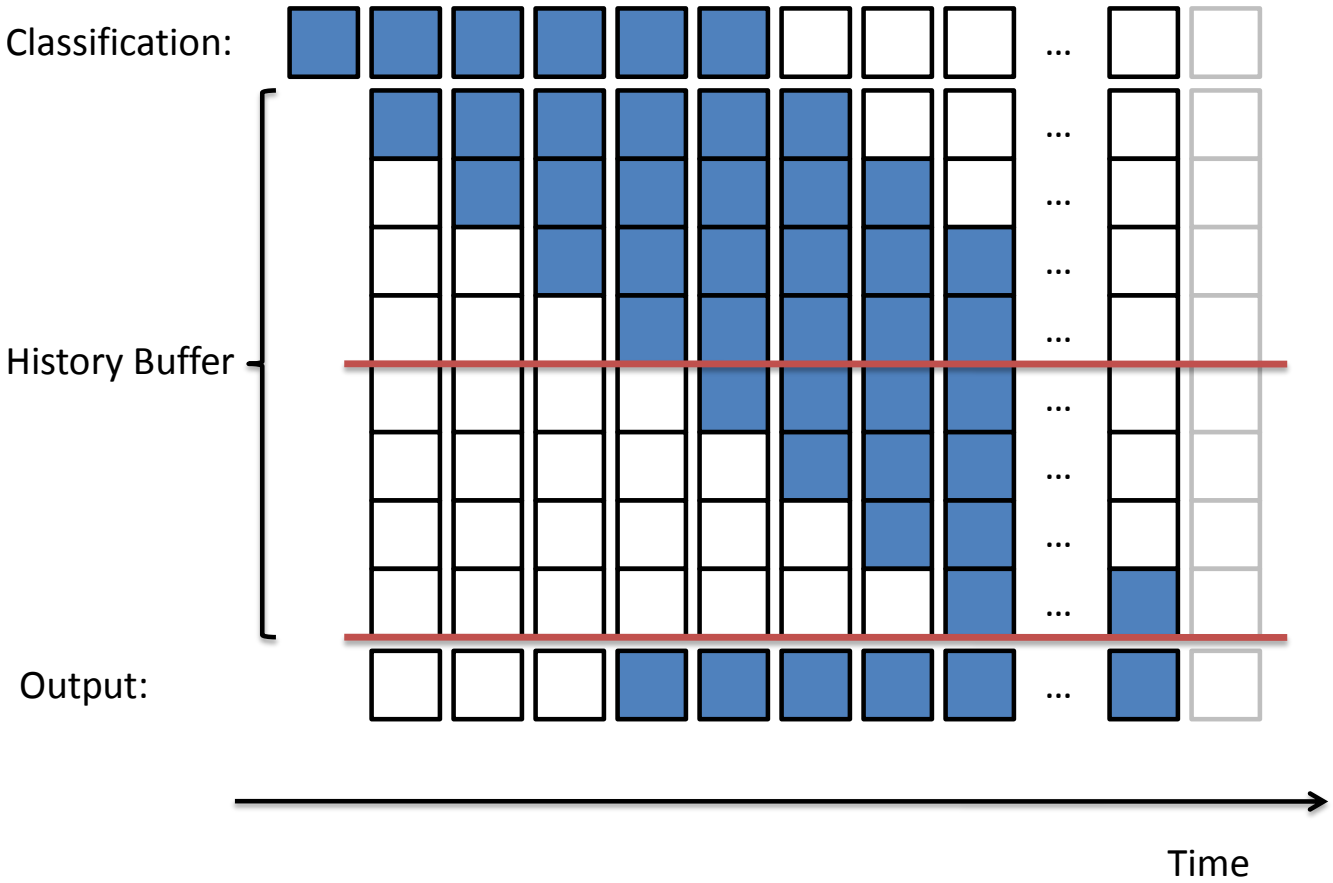

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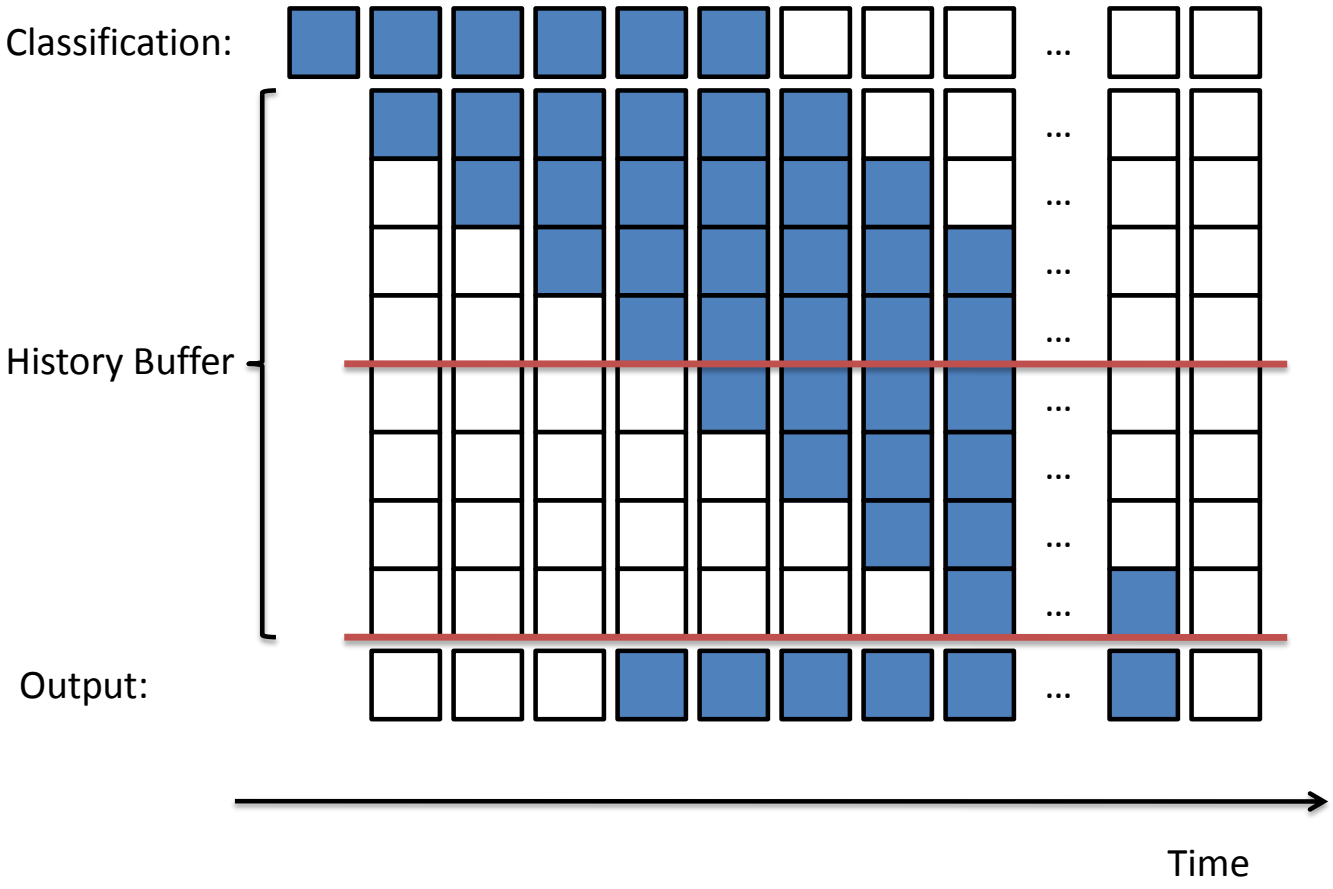
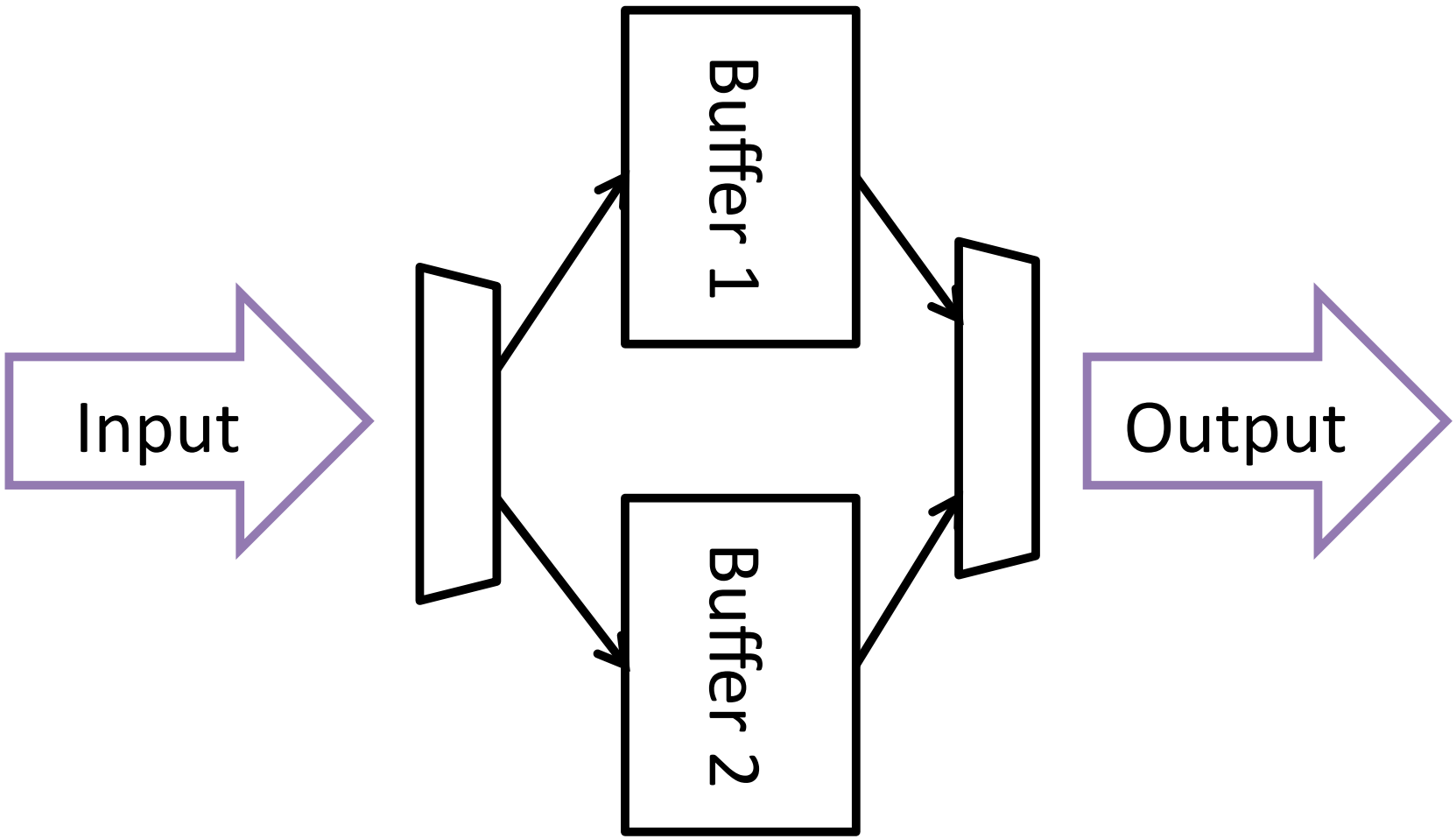
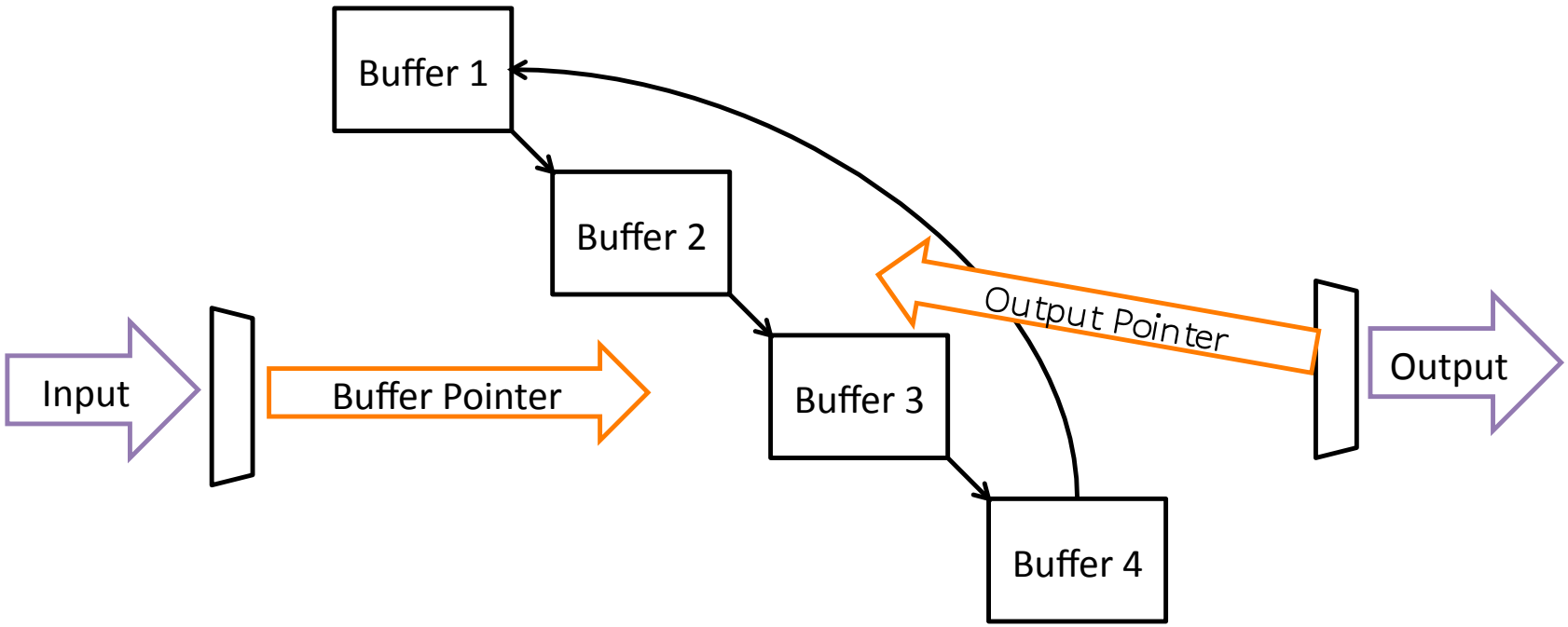


Double Buffering



Circular Buffering



Successes

- Near real-time recording of handwriting
- Rejection of user's hand and writing utensil from image stream
- Rich writing interface: erasing, multiple colours
- Playback of previous writing

Future Improvements

Recording

Save to PC

Future Improvements

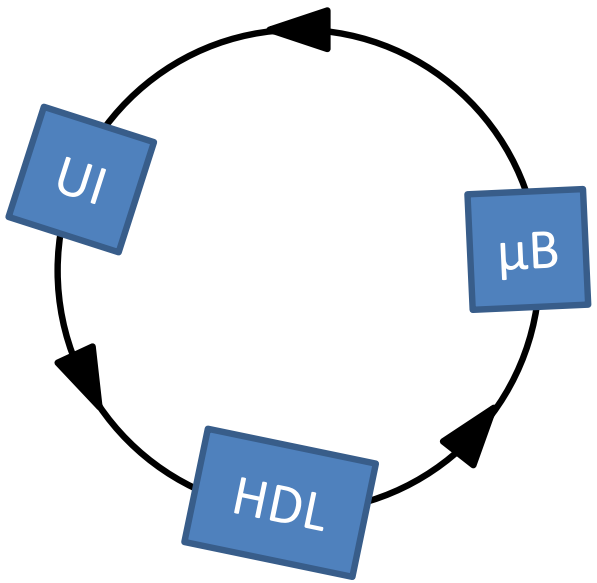
Recording

Save to PC

Design Philosophy

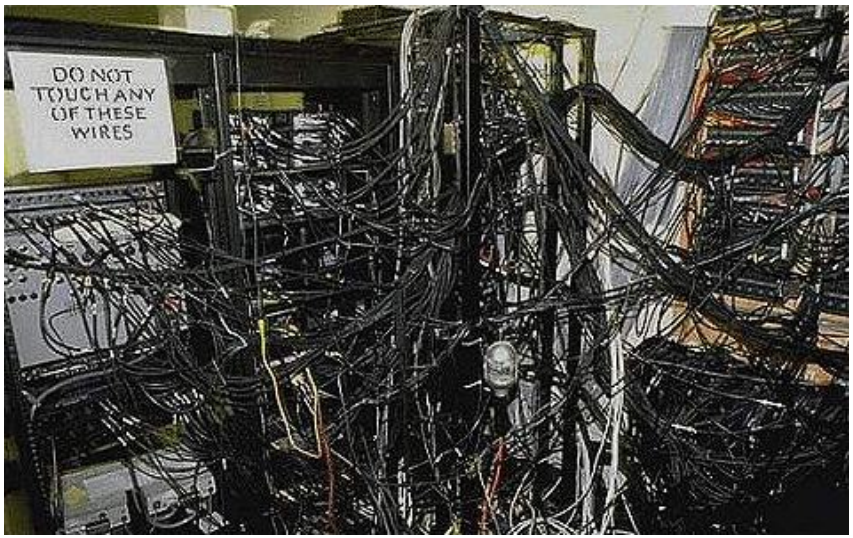
Our **philosophy**:

1. No integration stage: rotate tasks
2. Explore alternatives concurrently and choose best
3. Adapt design quickly



Lessons Learned

- Design complexity and tough performance criteria don't always lead to most effective system
- Solve as much as possible in **software**



DEMO