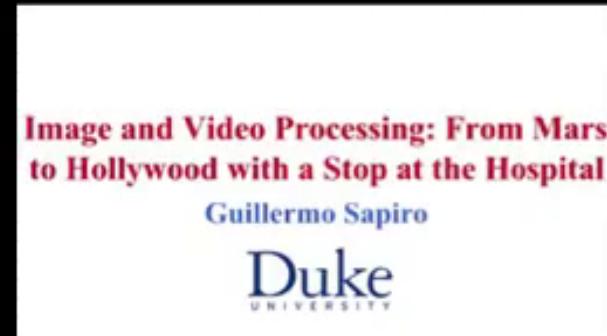


# Behind Roto Brush: Adobe's Video Segmentation



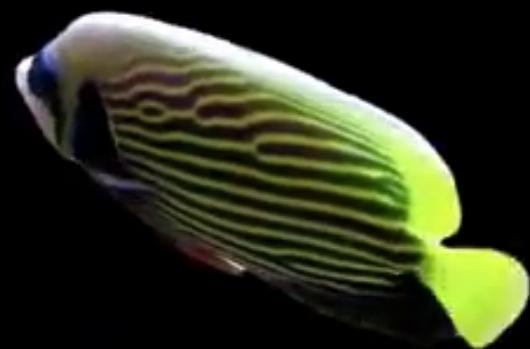
*After Effects*

*Images Courtesy of: ACM – SIGGRAPH and ECCV; Xue Bai  
Jue Wang; David Simons; Adobe*



# Problem: Interactive Video Segmentation

- Pixel level accuracy
- Minimal user intervention
- Interactive real-time



# High-Quality Video Object Cutout



Original



# Challenges



overlapping color distributions



weak boundaries



topology changes, dynamic backgrounds



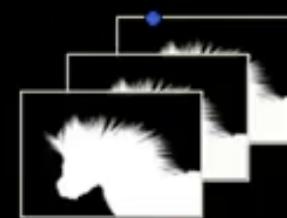
# Features

- Accuracy
  - work with complicated scenes
- Robustness
  - on diverse data
- Practical workflow
  - easy to converge/interact
- Computational efficiency
  - Faster than 2 frames per second

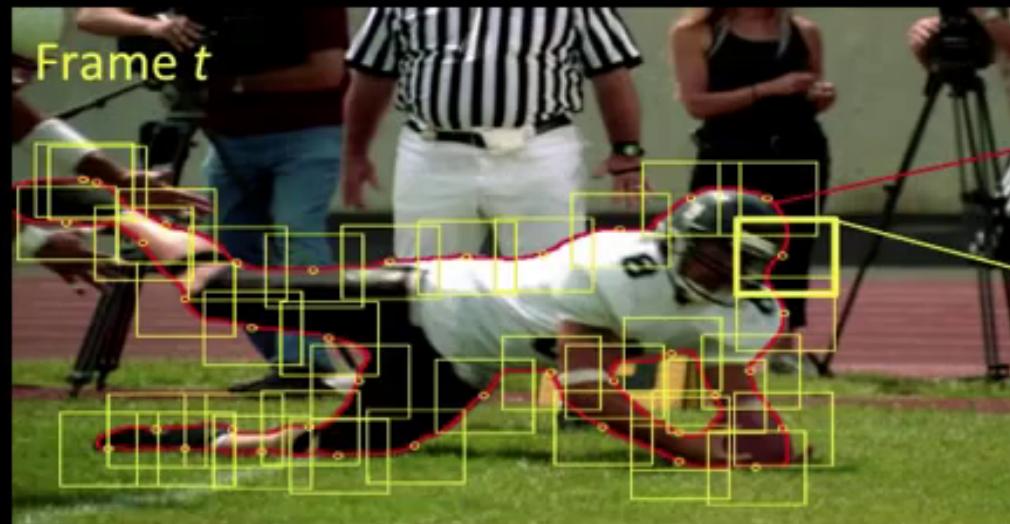


# Algorithm Overview

- Localized classifiers
- Multi-frame propagation
- Local correction
- Post-processing

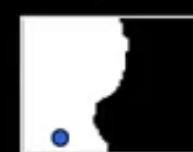
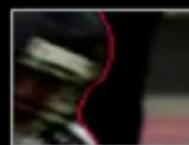


# Localized Classifiers



Existing  
segmentation

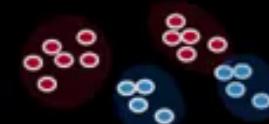
Local classifier  
window



Local window  $i$

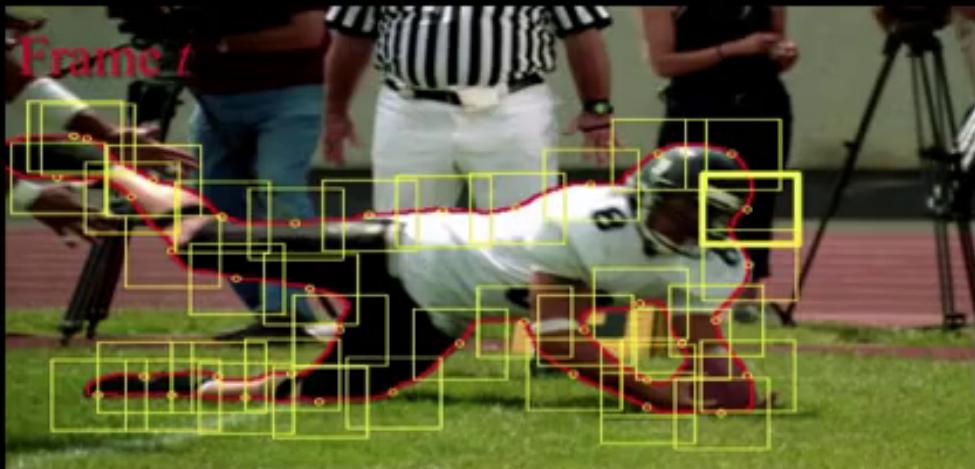
Shape Prior

Color Models



Local classifier  $i$

# Localized Classifiers

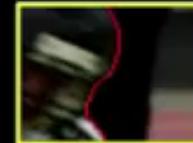


Frame  $t$



Graph cut

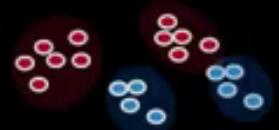
training



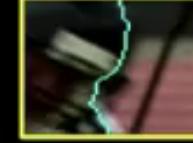
shape



GMM's



testing

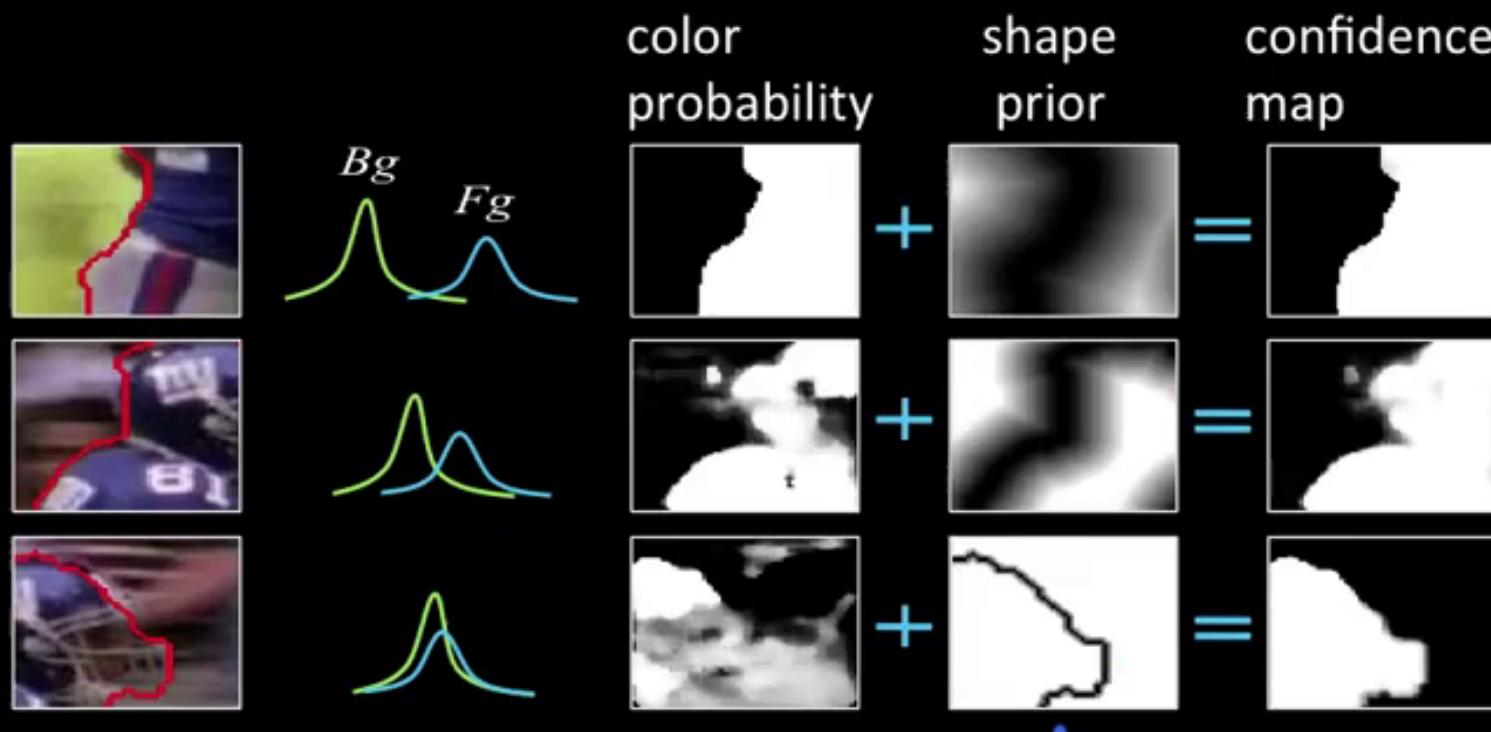
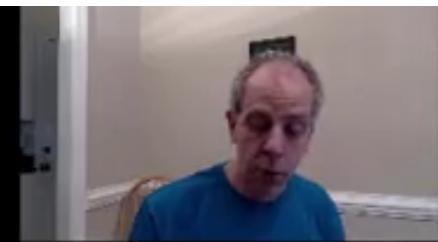


Integration



# Adaptive Color-Shape Integration

- If colors are separable, trust color model
- If not, trust shape prior



# Single-Frame Propagation Example



frame  $t$  (segmented)



frame  $t+1$  



global color model



local color models

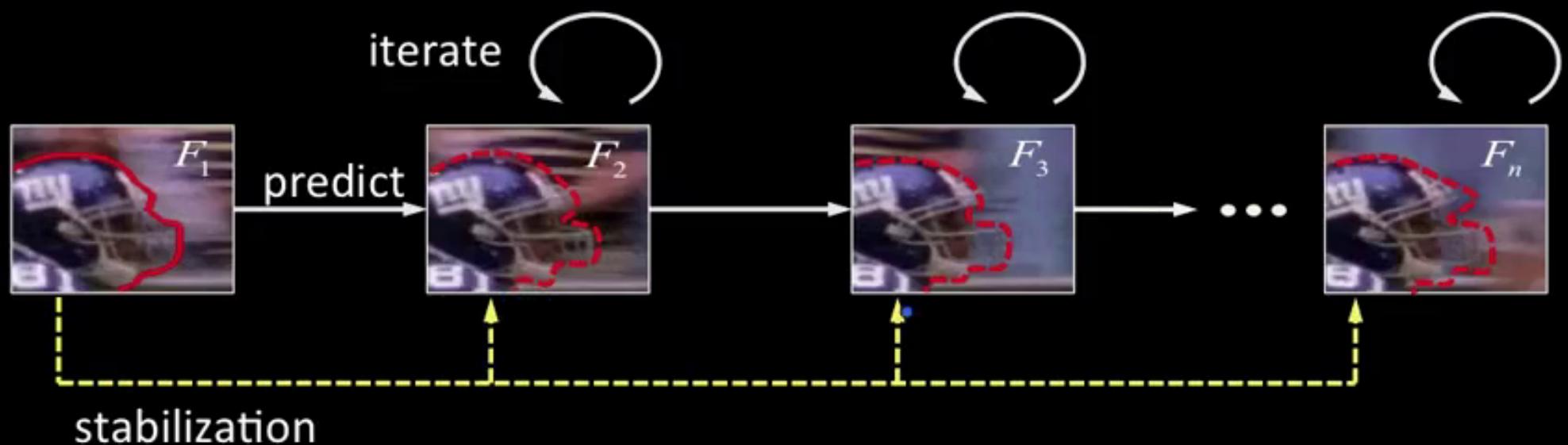


local color models +  
local shape prior

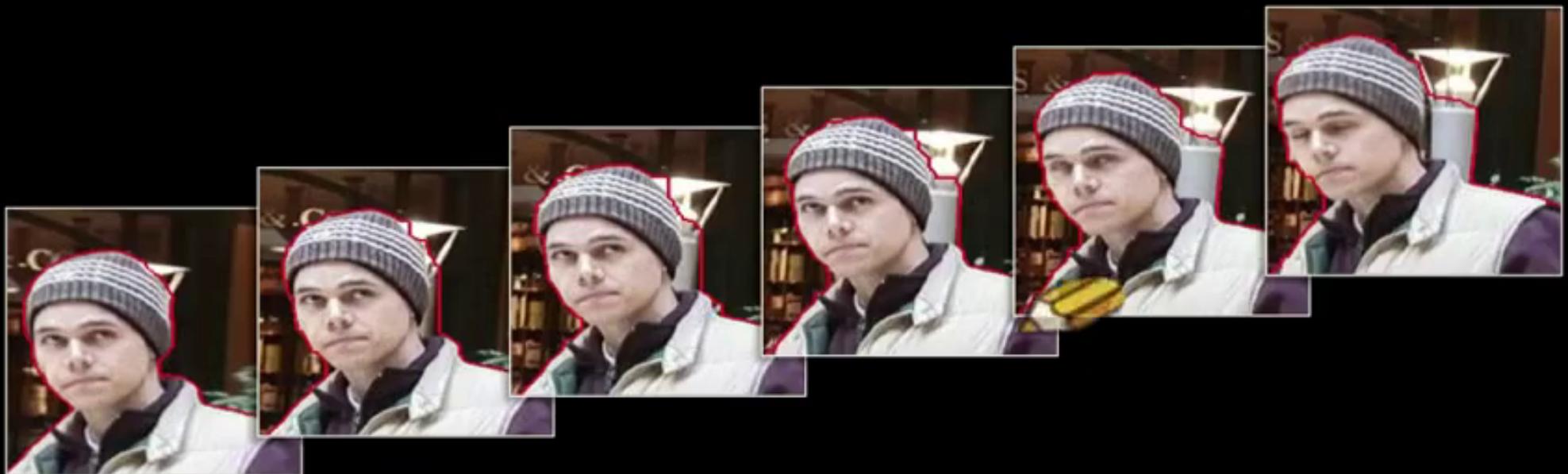


# Multi-Frame Propagation

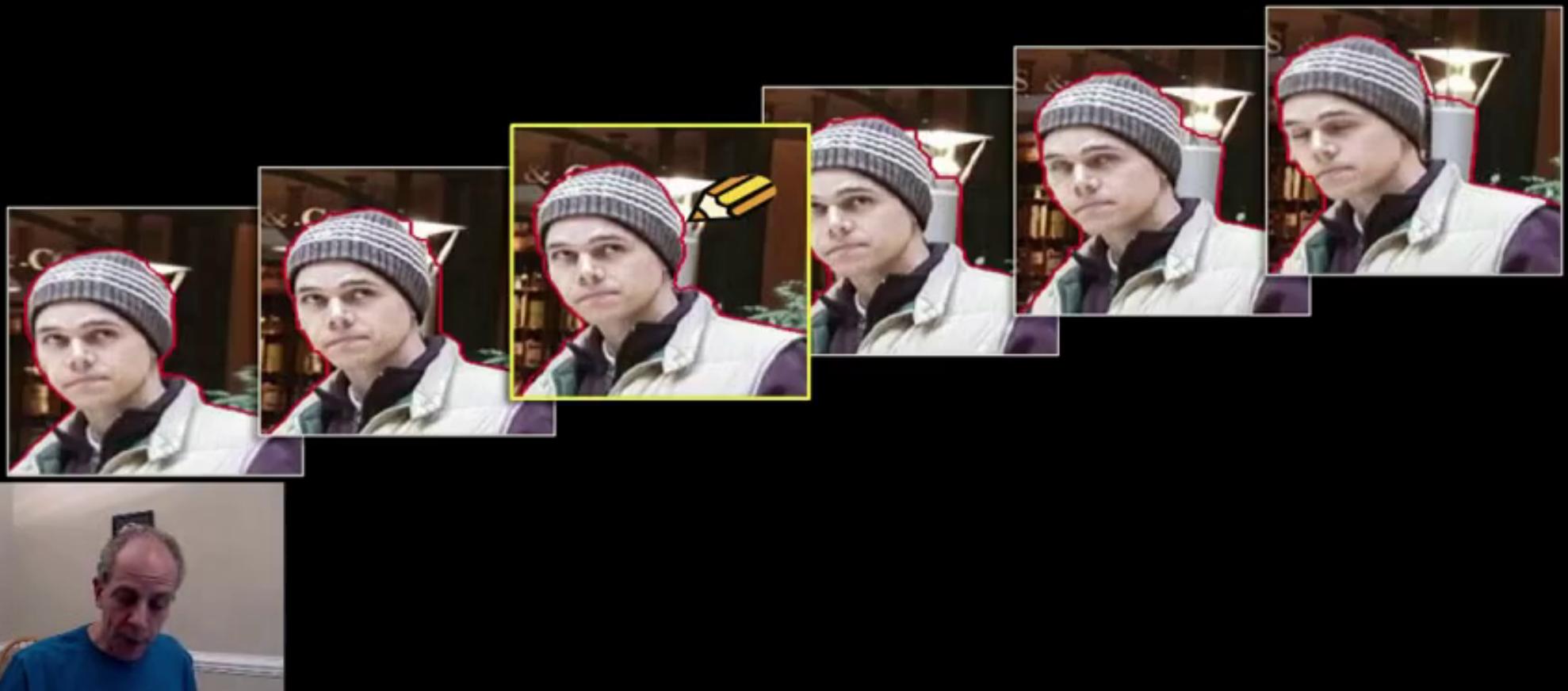
- Practical workflow
- Stabilization



# Spatial-Temporal Local Correction



# Spatial-Temporal Local Correction



# Spatial-Temporal Local Correction

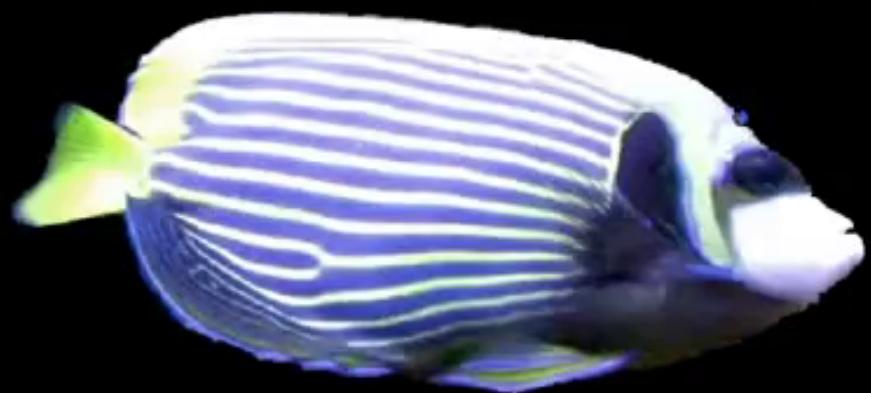


Affects only a few local windows

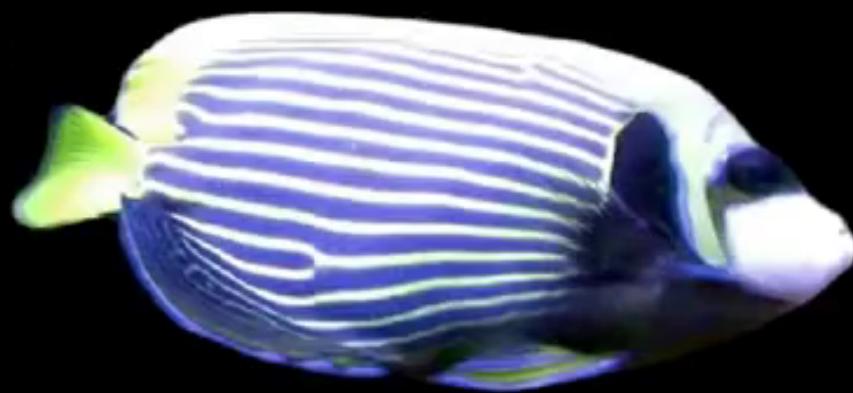
Propagates changes temporally



# Post-processing



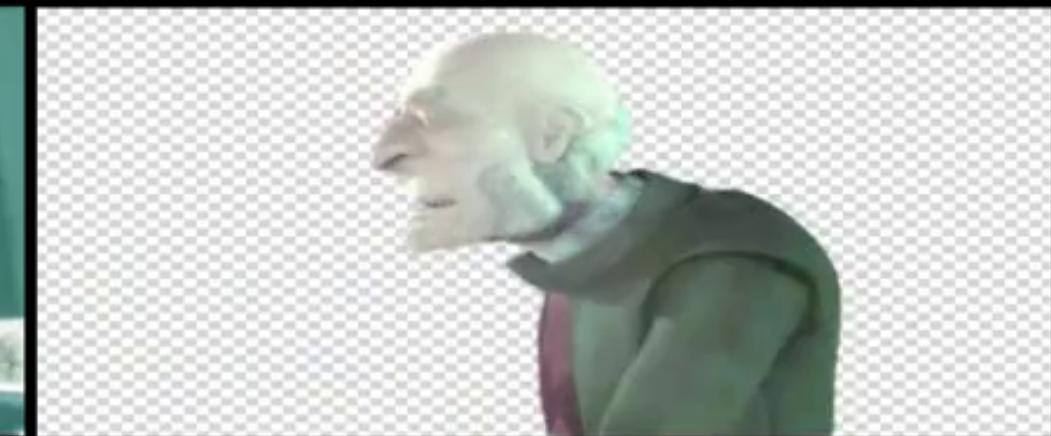
before



after



# Results



720×406 185 frames

# Results



720×576 50 frames

# Results



original



848×480 232 frames



filter



relight



composite



Original

Composite



473×588



Original



Composite



504×380