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GRAPHICS & MEDIA LAB
VIDEO GROUP

100+ Times Faster Video Completion by Optical-Flow-Guided Variational Refinement

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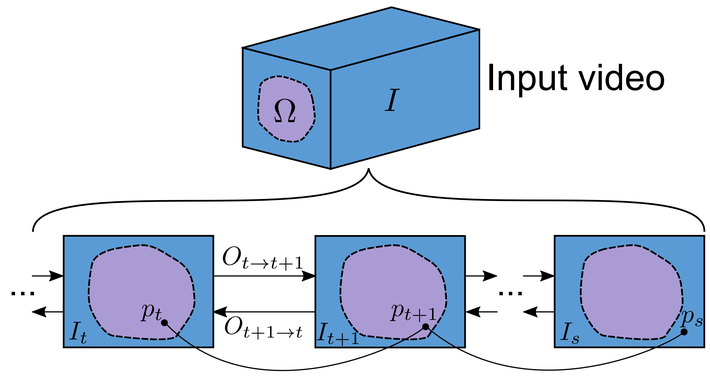
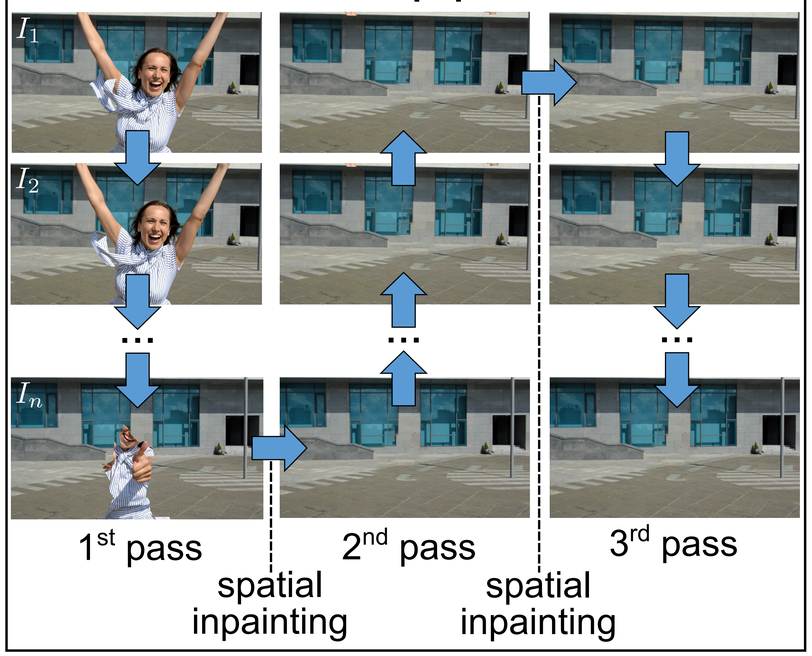
Basic idea

Construct the mapping $V : \Omega \mapsto I \setminus \Omega$ from the missing region Ω to known regions by decomposing it into inter-frame flow fields:

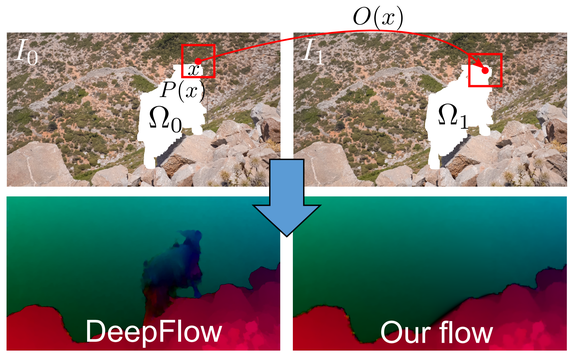


General pipeline



Main algorithm steps

1) Joint estimation and completion of an optical-flow field $O = (u, v)$



$$E(O) = \sum_x \Phi\Big(\sum_{\substack{p \in P(x) \\ p \notin \Omega_0 \\ p + O(x) \notin \Omega_1}} w_p \Big(\nabla_{O(x)} I(p) - \frac{\sum_p w_p \nabla_{O(x)} I(p)}{\sum_p w_p} \Big)^2 \Big)$$

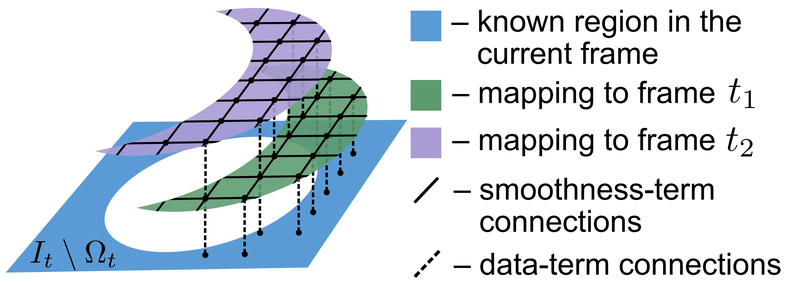
$$+ \alpha \Phi\big(||\nabla u(x)||^2 + ||\nabla v(x)||^2 \big)$$

$\Phi(s^2) = \sqrt{s^2 + 0.001^2}$ – robust penalty function

$w_p = (1 + ||\nabla I_0(p)||^2)^{-1}$ – normalization weight

$\nabla_{O(x)} I(p) = I_0(p) - I_1(p + O(x))$ – brightness difference

2) Frame-by-frame variational refinement



3) Illumination adjustment by applying modified Poisson blending

Results

- Near state-of-the-art subjective quality on the DAVIS data set (26 test videos)
- 140 times faster thanks to frame-by-frame processing and our fast joint optical flow estimation and completion algorithm

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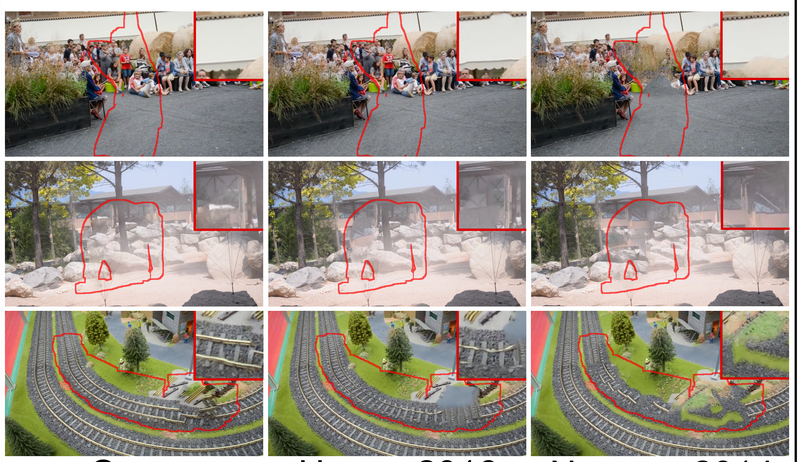

See numerous video examples at
http://videocompletion.org/fast_video_completion/