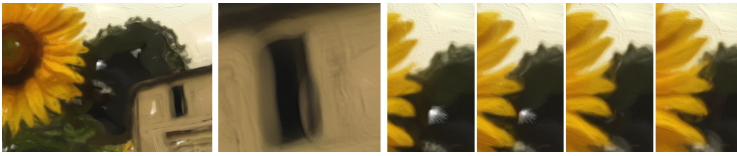


# Towards Simulation of Handmade Painterly Animation

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**Figure 1:** Motion is rendered with paint over previous frames while static regions are not repainted.

## 1 Introduction and Motivation

Hand made painterly animation offers an appealing aesthetic appearance. As researches on automatically rendered painterly animation mostly focus on temporal coherence, the generation of an animation that could have been done by hand remains an open challenging problem. This poster focuses on automatic painterly animation rendering mimicking appearance of hand made footage.

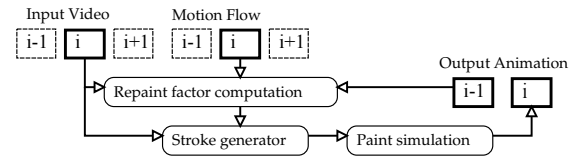
In general, hand made painterly animation are done using paint-on-glass techniques. The artist paints with his fingers or other tools on a retro-lighted glass canvas. The animation is created by successive shots of the glass canvas. Each new frame of the animation is created by the artist who modifies the painting on the glass canvas. Paint strokes are added over previous strokes to convey subtle changes and motions, the artist also erases and smears paint with specific brush strokes. By carefully choosing where to place new strokes and where to erase, the resulting animation exhibits some kind of temporal coherence with respect to the repaint of the whole image at each frame. This observation is used by Hertzmann and Perlin [2000] and Park and Yoon [2008] to produce a painterly animation. While these works focus on strokes placement which provides a pertinent set of strokes to paint each frame, they do not address the specific color exchanges that occurs while painting. On the other hand, plausible paint appearance is obtained by media simulation techniques as Impasto [Baxter et al. 2004] or Detail-Preserving Paint Modeling for 3D Brushes (DPPM) [Chu et al. 2010]. These simulations perform a bidirectional exchange of paint color between canvas and brush to model smear of paint while rendering a stroke.

In this poster, we propose to render painterly animations with a visual aspect tending toward hand made results. To this end, we combines two techniques: an automatic strokes generation based on the multi-layered algorithm of Hertzmann and Perlin and a paint simulation based on either Impasto or DPPM.

## 2 Our Approach and Observations

Our approach follow the pipeline presented in Fig. 2. Each frame of the input video is processed sequentially. We compute a repaint factor based on the input video frame, its motion flow and the previous painted frame. This repaint factor drives the computation of strokes which are painted by the paint simulation.

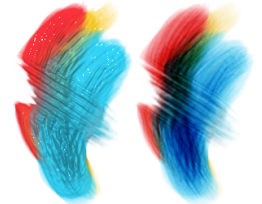
**Repaint factor** This factor tells for each pixel how likely a new stroke will be generated by the stroke generator. It combines the cumulative difference between frames of the input video, the difference between current painting and current video frame, motion flows and edges detected in input video.



**Figure 2:** Painterly rendering pipeline.

**Stroke generator** As in Hertzmann and Perlin approach, painting a frame is decomposed in several layers. To compute new strokes we first compute a repaint factor for each pixel. Then, we follow Hertzmann and Perlin algorithm to determine stroke position and shape. Current results are encouraging. Nevertheless, we observe that the generated strokes are not always the expected ones. Our stroke generator could be improved using, for instance, relaxation or global optimization.

**Paint simulation** Each stroke is rendered computing a set brush footprints along the stroke path. Each footprint is then printed onto the canvas using the paint simulation. We have tested two paint simulation approaches, Impasto and DPPM, we now review pros and cons of each. **Impasto** provides physically inspired and provides plausible paint appearance and color blending. As this paint simulation also computes paint thickness, paint is easily rendered as front lighted or transparent retro lighted, as illustrated on the picture on the right. However, always painting over with overlapping strokes produces *paint accumulation* that needs to be erased either with an ad-hoc function or empty brush strokes. **DPPM** renders sharp and crisp color blending and color streaks, which is visually close to real paint blending. This phenomenological approach does not take care of paint accumulation, and retro lighted rendering is then impossible. An area of investigation is an hybrid approach allowing to obtain both semi transparent retro lighted rendering and color streaks.



The use of a paint simulator allows to render erase and smear strokes that are widely used by hand. We are investigating the automatic generation of specific strokes to erase over-painted regions and to smear the paint according to motion flow.

## References

- BAXTER, W. V., WENDT, J., AND LIN, M. C. 2004. IMPaSTo: A realistic model for paint. In *NPAP'04*.
- CHU, N., BAXTER, W. V., WEI, L.-Y., AND GOVINDARAJU, N. 2010. Detail-preserving paint modeling for 3d brushes. In *NPAP'10*.
- HERZMANN, A., AND PERLIN, K. 2000. Painterly rendering for video and interaction. In *NPAP'00*.
- PARK, Y., AND YOON, K. 2008. Painterly animation using motion maps. *Graphical Models* 70, 1-2, 1 – 15.

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