Making Space for Time in Time-Lapse Photography

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Traditional time-lapse techniques accelerate footage to offer a view of events that is otherwise difficult to experience. Recent techniques, such as Image Fusion [Raskar et al. 2004] or video cube sampling [Cohen et al. 2003], offer techniques to summarize spans of time in a single image.

While both traditional and recent time-lapse techniques offer valuable methods for understanding temporal events, they are generally limited to exposing near-term, coincident events. Phenomena that occur periodically, or over very long periods of time, may go unnoticed when using these techniques.

We introduce Time Maps, a method that produces summaries of time for images captured from the same vantage point. Time Maps employ a $\mathbb{R}^3 \rightarrow \mathbb{R}^2$ function that maps points in an output image to pixel offsets and to moments in time. Our unifying framework, constituting our primary contribution, generalizes existing methods, while offering additional output control. Various styles are possible: *tree rings*, *tiled views*, or combinations thereof.

Tree rings map pixel locations in the output image to temporal offsets to reconstruct the scene from multiple moments in time. For example, given three snapshots captured at morning, noon, and night, a Time Map can be directed to divide the destination frame into three regions, each corresponding to the three times of day (Figure 1). Alternative temporal mapping functions are possible, such as the radial Time Map in Figure 2 that summarizes a 48 hour period.

Tiled views summarize spans of time by tiling the sampled images. Figure 3 shows a tiled view of a city street in Alaska, for the same time of morning in the first four months of the year (January to April). These types of Time Maps are particularly well suited for revealing long-term trends and periodic events. In this example, details in the individual images are deemphasized to foreground seasonal changes in day length: The transition from dark to light demonstrates that days gradually grow longer at this time of year.

We are exploring artistic and educational styles of Time Map renderings for a four month data set collected from 25 webcams positioned around the world.

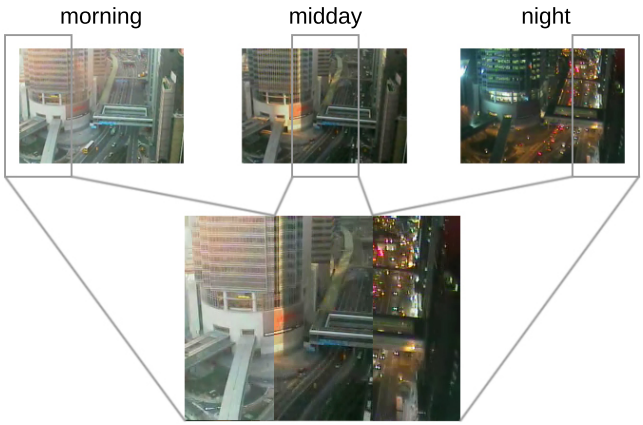

Figure 1: Basic Time Map

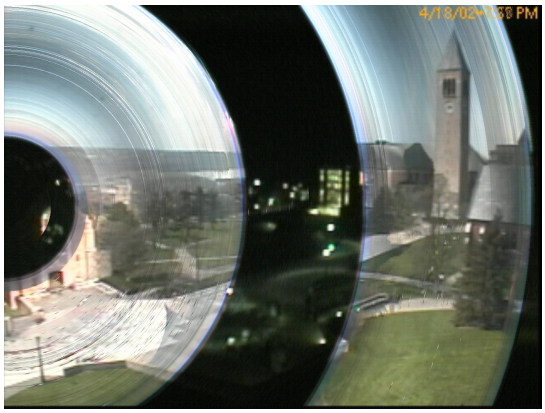

Figure 2: Radial Time Map

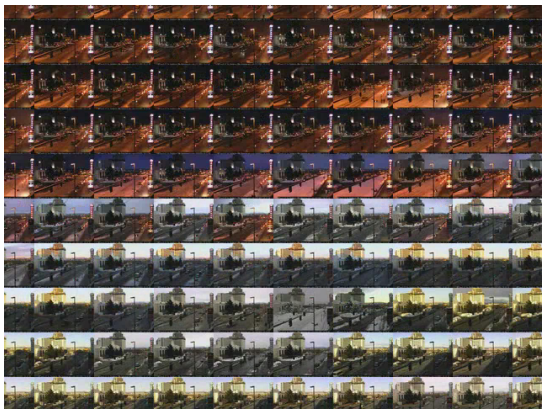

Figure 3: Tiled view showing the same time of morning for 110 consecutive days (January to April) of a city street in Alaska.

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References

COHEN, M. F., COLBURN, A., AND DRUCKER, S. 2003. Image stacks. In *MSR-TR-2003-40*.

RASKAR, R., ILIE, A., AND YU, J. 2004. Image fusion for context enhancement. In *NPAR 2004: Third International Symposium on Non Photorealistic Rendering*, To Appear.