Slicing the Aurora

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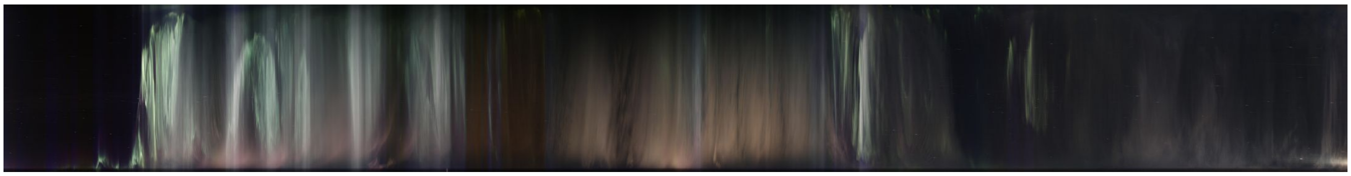

Figure 1: An example Keogram from which we will create a digital print, representing captured images of the night of January 1, 2016. The aurora is clearly visible in the first third, then the sky is cloudy in the middle of the night, and there is little activity in the final part right before dawn.

Abstract

We have generated large-scale digital prints from a sequence of photographs of the northern sky taken over the course of one night. Each image is aggregated across time creating visually appealing and intriguing images – or Keograms – that visualize *Aurora Borealis (Northern Lights)* activity as well as interesting movements of clouds and stars that occurred that night.

1 Keograms

The word Keogram is derived from 'Keoeeit' [7], the Inuit-word for the Aurora Borealis or, in short, the aurora. A Keogram is an image that represents a series of images taken over the course of one night. Each image is represented by a vertical line of pixels in the resulting Keogram, sorted on time from left to right, as shown in Figure 1. Keograms are a type of timeline that start with the evening on the left and end with the next morning on the right. Like the nights themselves, the Keograms differ in length. As Keograms transform a large series of images over time into one single image, they are a good way to get a quick overview over the content of the series. Keograms can be used to identify occurrences of the aurora and other features like clouds during the course of the night.

Eather et al. [4] first described and used Keograms in the seventies for studying the aurora. They describe the latitude-time morphology of auroras using scanning photometer data. The cameras used for taking these images are usually equipped with a wide-angle lens to fit the entire sky in one image. Also, these cameras are often only used to capture a small band of frequencies particular to the aurora and not the whole range of the visible spectrum. The images we used for this project were captured using an off-the-shelf DSLR camera that captures all visible light.

2 Exhibition and Relation to Metamorphoses

We intend to exhibit up to five large-scale digital prints of Keograms. The images we selected (see Figure 2) reflect the wide variety of visual patterns in Keograms and show how an entire night of captured images can be represented in a single image. Through the transformation from a time-dependent to a time-independent medium, they offer a condensed view on the events happening in the night sky. This transformation provides a new view on sights like the aurora or illuminated clouds, which tells a story about their appearance, their movement and their superposition or interference with each other. The resulting images often differ from night to night and feature diverse colours and textures. Each image has unique characteristics, which often results in beautiful images with distinct patterns and colour pallettes.

The work has not yet been exhibited, but has drawn strong interest from colleagues and visitors to our lab when shown on a large high-resolution wall display.

3 Related Work

To the best of our knowledge, appreciating a Keogram as art is novel. However, there are aesthetically similar works of art that utilise similar techniques.

One prominent example is the work of German artist Gerhard Richter. His 2012 "Strips" [8] explore the effect of colorful, parallel lines, which are presented as large-scale prints. Two very similar projects with their origins in popular culture are "The Colors of Motion" [3] and "moviebarcode" [2]. Here, each frame of a movie is transformed into an line colored according to the (average) color of the frame. Then, stacking all the lines creates an image of the movie. The results can be explored and purchased as prints on their websites. Another project with a related idea is "Waters" [5] by Xárene Eskandar, which also splits a video into smaller components. However, the result is another video.

The basic technique of Keograms also has been used in scientific settings. Two works that use it for similar goals are "Exploring video streams using slit-tear visualizations" by Tang et al. [9] and "Multi perspective panoramic imaging" by Haenselmann et al. [6].

4 Technical Details

We downloaded images from the Data Website [1] of the Space Physics Groups of the University of Calgary. These images were captured using a single DSLR as part of the AuroraMAX project.

For each night, there are thousands of images depending on the length of the given night (approximately 1 GB / night). Our Python script reads a vertical line of pixels in the middle of each image and combines them into one output image.

For this submission, we generated one image for each night from January to March 2016. We then selected a set of ten images (see Figure 2) based on unique or aesthetically pleasing features and cropped the most interesting parts.

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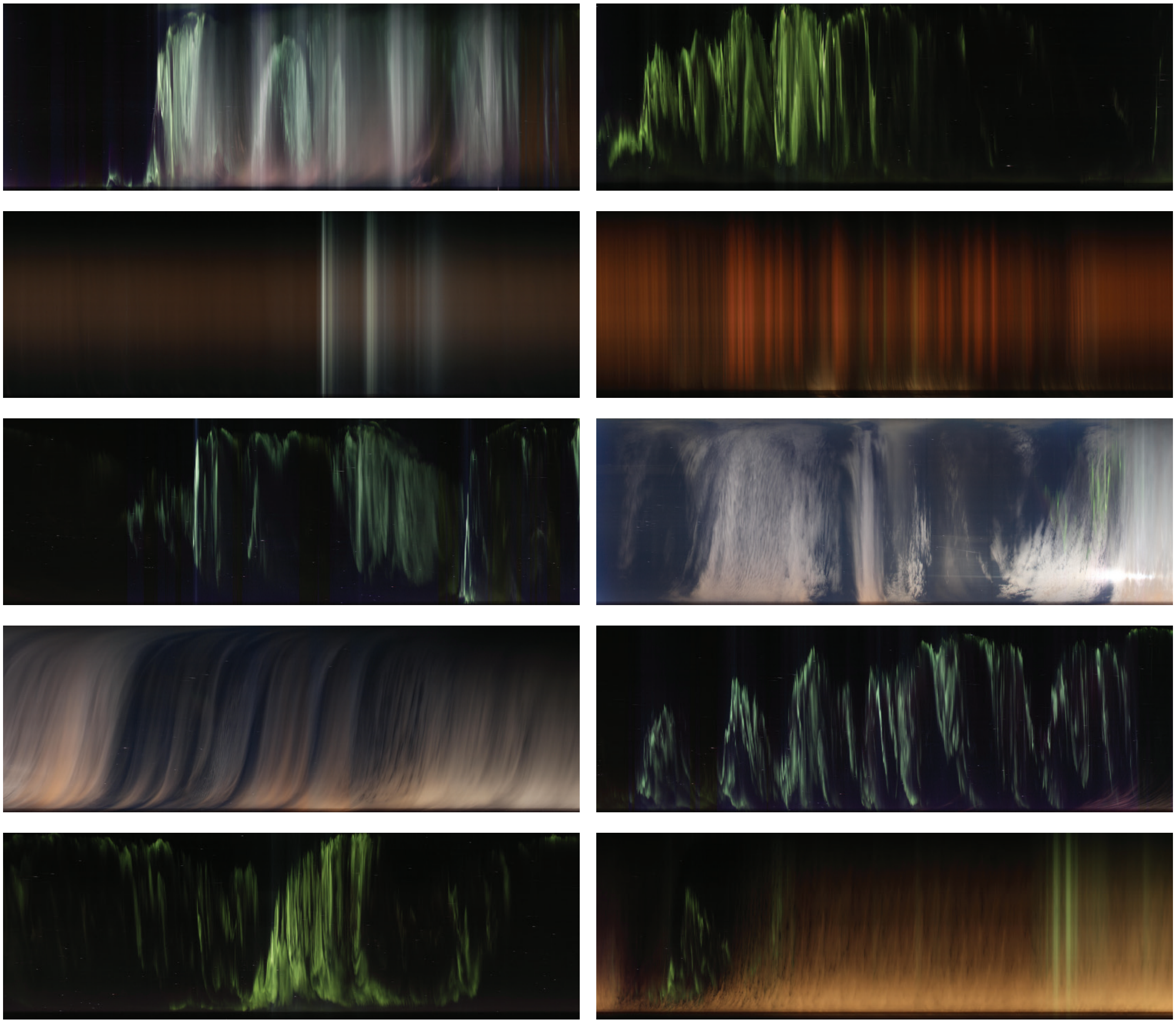

Figure 2: Thumbnails of the ten images to be displayed. High-resolution versions of these images are available in supplemental material.

5 Installation Requirements

This piece should be hung on the wall. The prints will not be framed, so utilising binder clips and tacks will work for our hanging requirements. The piece would benefit from indirect lighting as there is a large content of black that could reflect back at viewers. Although we submit ten images here, we anticipate the committee will choose a smaller selection of these.

Additionally, we consider installing a display showing a video of a stop-motion animation of captured images. This would require a small table with room for the display.

6 Biographies

Sebastian Lay is a media informatics Masters student from the TU Dresden. He is currently a visiting student in the InnoVis group at the University of Calgary and is interested in the cross-section of traditional photography and computer-generated images.

Jo Vermeulen is a Postdoctoral Fellow in the InnoVis group at the Interactions Lab at the University of Calgary. His research focuses on addressing interaction challenges with non-traditional interactive technologies, including ubicomp spaces and interactive surfaces.

Charles Perin is a Postdoctoral Fellow in the InnoVis group at the Interactions Lab at the University of Calgary. He is broadly interested in work at the intersection of information visualization and human-computer interaction.

Eric Donovan is a Professor in Physics and Astronomy and Associate Dean Research, Faculty of Science, University of Calgary. His research is on mass and energy transport in the near Earth plasma environment and involves observations of the aurora using ground- and space-based digital imagers.

Raimund Dachselt is a Professor of Computer Science at the TU Dresden and head of the Interactive Media Lab Dresden (Chair of Multimedia Technology). His research interests include natural human-computer interaction, interactive information visualization and 3D User Interfaces.

Sheelagh Carpendale, a Professor in Computer Science at the University of Calgary, leads the InnoVis research group. Her research on information visualization, large interactive displays, and new media draws on her background in Computer Science, Art and Design. She has found the combined background invaluable in her research.

Acknowledgements

We would like to thank Lindsay MacDonald for her input and suggestions on how to show this work.

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