

Parameter Settings Exploration in Visualisation by Using a Semi-automatic Process

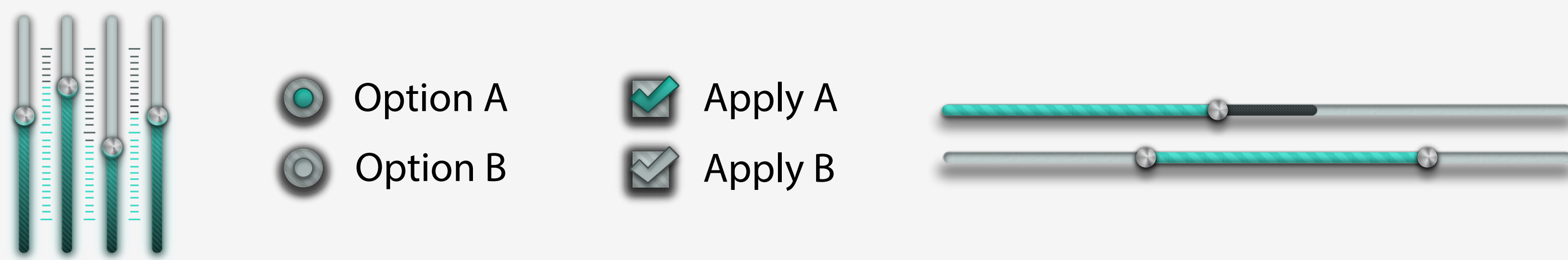
Masterstudium:
Visual Computing

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Problem Statement

One of the most time consuming and difficult tasks in visualisation is finding suitable parameter values for achieving the desired results. Standard user interfaces in volume visualisation software for example provide sliders for every single parameter. By using them the user can change the actual value of the parameters and therefore the intensity of their influence. The aim of this thesis is to explore how an image-centric method can be utilised for efficient specification of parameter values for visualisation algorithms.



Contribution

This work contributes by:

- a novel approach of setting parameter values
- using locally linear embedding in combination with kMeans++ and DBScan as similarity measurement
- calculating the locally linear embedding coordinates of images and of kMeans++ clustering in parallel
- an automatic method to determine the parameters for the DBscan

Parameter Selection Advisor - ParSAd

With our approach we want to achieve that a user can find suitable parameter values for many different parameters of a visualisation algorithm without setting them manually with common GUI elements.

1. Generate Images

Rendering and saving arbitrary number of images having different parameter values.



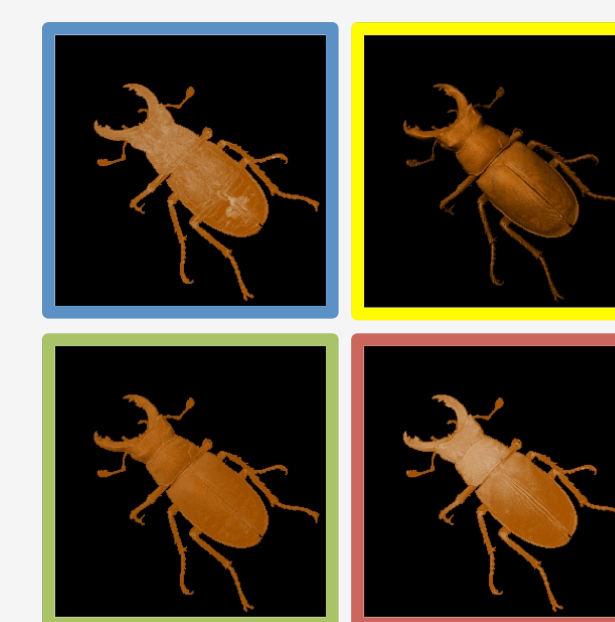
2. Mapping and Clustering

Mapping every image to locally linear embedded coordinates and clustering them by using kMeans++ or DBScan. All in real-time.



3. Displaying Images

Automatic determining of images closest to every cluster centre and displaying them to the user in a grid interface. He/She selects one or more images which are closest or have anything in common with the visualisation he/she imagined.



4b. Refine Settings

No further images belong to the selected cluster(s). We refine the range in which the parameter values are varied and generate new images with, which are similar to the already selected ones.

5. Final Visualisation

The image selected represents the final visualisation and therefore also the final values of the parameters.

4a. Explore Settings

The selected image(s) belongs to a cluster (belong to clusters) containing similar images. These images are than all taken and clustered again

Results and Conclusion

1. Locally linear embedding works in combination with each of the two clustering algorithms. Equal images were assigned to the correct clusters.
2. The automatic detection of epsilon improves the results of DBScan if an adequate value was found for it. Furhter this leads to that DBScan works as good as kMeans++ to cluster the images. Otherwise kMeans++ is the recommended clustering algorithm for our approach.
3. ParSAd is able to reproduce volume visualisations which parameters where set manually. By conducting a test our self and a small user study, we proved that when using ParSAd one needs less steps and knowledge of finding values for parameters. Parallel implementation of locally linear embedding and kMeans++ enables fast pre-processing.



Manually created visualisation



Visualisation created with ParSAd

	Steps Manually	Steps ParSAd	Time Manually	Time ParSAd	Used Parameters Manually	Used Parameters ParSAd
Physicist	25 steps	17 steps	12 minutes	14 minutes	7 parameters	3 parameters
Illustrator	19 steps	16 steps	5 minutes	7 minutes	6 parameters	3 parameters

Results of the user test