Thesis topics in color research group 4.5.2009

1. Topic: Information search on mobile device

Contact: Juha Lehtonen

Description: ID is photographed by mobile phone and send to local server which analyses the image and returns more information about the object of which the ID is connected.

Compensation: -

2. Topic: Realization of partially negative filters in digital imaging

Contact: Pauli Fält

Description: Spectral images are taken from objects and sufficient PCA vectors are chosen. Projections to those base vectors are realized by using multiple narrow band filters.

Compensation: -

3. Topic: The safety of LED light sources in medicine

Contact: Pauli Fält

Description: Led parameters (radiation power, albedo, heat generation,…) are measured and compared to e.g. ANSI standards (laser vs. “white light”)

Compensation: -

4. Topic: Update to Color Toolbox

Contact: Pauli Fält

Description: Collect self-made updates from the group and renew the toolbox. Erroneous inputs should be specially taken in concern.

Compensation: -

5. Topic: Vignetting compensation by software

Contact: Pauli Fält

Description: Define the amount of vignetting (and possibly other aberrations) on 2D spectral cameras and find out how to compensate the effects in spectra afterwards.

Compensation: -

6. Topic: Effect of the polarization when spectral imaging

Contact: Pauli Fält, Birgitta Martinkauppi

Description: Define how polarization affects the spectral imaging. How does the glossiness affect?

Compensation: -

7. Topic: Estimation of the camera sensitivity by RGB-spectral measurements

Contact: Ville Heikkinen

Description: Concentration on regulation parameter for different cameras and quadrature model affect in integral approximation.

Compensation: -

8. Topic: Spectral estimation by using spectral camera and scanner

Contact: Ville Heikkinen

Description: Combination of spatially adaptive filter (reduce noise) and linear+nonlinear models in estimation of spectra.

Compensation: -

9. Topic: Methods for comparing spectral data sets

Contact: Ville Heikkinen

Description: Computational analysis of the differences between spectral sets. How does the eigenvectors in one set be suitable for another one?

Compensation: -

10. Topic: Public spectral data bases

Contact: Ville Heikkinen, Jussi Kinnunen

Description: Chart the spectral data sets in internet and cluster spectra. How does the noise affect the data?

Compensation: -

11. Topic: Noise in spectral cameras

Contact: Ville Heikkinen

Description: Measure and analyze noise on the spectral cameras (max. 6) and compare the noise to models. Estimate the amount of data which is reliable and which is distorted by noise.

Compensation: -

12. Topic: PCA vectors vs. universal base

Contact: Ville Heikkinen

Description: Compare universal bases and PCA base for standard spectral sets.

Compensation: -

13. Topic: Optimal conditions for spectral estimation

Contact: Ville Heikkinen

Description: Find optimal camera sensitivities / transmittance filters /light sources for estimation of spectra for classification or segmentation on specific kind of data.

Compensation: -

14. Topic: Effect of the preprocessing when classifying the spectral data

Contact: Ville Heikkinen

Description: Find out how derivates, de-trending, standardizing, normalizing, outliers, etc effect before classification.

Compensation: -

15. Topic: AdaBoost for spectral images

Contact: Jukka Antikainen, Jussi Kinnunen

Description: Realize AdaBoost classification for spectral images in spectral domain by parallel computing on graphics card.

Compensation: -

16. Topic: Color changes in energy saving lamps

Contact: Jussi Kinnunen

Description: Study on how the color change in energy saving lamps in time.

Compensation: -

17. Topic: What has been done in color group?

Contact: Markku Hauta-Kasari

Description: Literature review of what has been done in the color group during these years. Articles, conference papers, all kind of theses, kind of samples and codes and algorithms should be found.

Compensation: -

18. Topic: UV-VIS-NIR-SWIR transparency of materials

Contact: Pauli Fält, Jussi Kinnunen

Description: Chart the transparency of different materials for the device we can measure e.g. metal under clothes. Use spectral based methods for boosting the visibility.

Compensation: -

19. Topic: Improve the interface in spectral database

Contact: Juha Lehtonen

Description: Improve usability of the database by making drag-n-drop functions and link ability to articles

Compensation: -

20. Topic: CUBA library for graphics card calculation of spectral images

Contact: Jukka Antikainen

Description: Chart the ready made algorithms for GPU environment. Create and test library for spectral image analysis.

Compensation: -

21. Topic: Spectra of plants

Contact: Birgitta Martinkauppi

Description: Certain plant types have different amount of tannins. Student should measure leaves of plants and test the correlation between results from spectral analysis and chemical analysis. The work is ecological significant because a possible correlation would make possible fast analysis for larger number of samples.

Compensation: -

22. Topic: Properties of spectral camera with different objectives

Contact: Jouni Hiltunen

Description: different targets are measured using several objectives. The results are compared and optimal objectives for different measurements are found out.

Compensation: -

23. Topic: Spectral images and analysis parallel

Contact: Jukka Antikainen

Description: To solve optimization problems related to PCA calculation and segmentation of spectral images by parallel computing. To make a library with PCA, ICA etc. for a cluster (ssh) from which is loaded for computing.

Compensation: -

24. Topic: Effect of compression for color information

Contact: Juha Lehtonen

Description: Different image format (jpeg, jpeg200, png) compressions cause color information which need to studied.

Compensation: -

25. Topic: The quantity and quality of pigments and dimensions of spectra

Contact: Birgitta Martinkauppi/Ville Heikkinen/Jussi Kinnunen

Description: To investigate the mixture of pigments. The color space is made from pigment mixtures in different proportions and its properties are investigated. PCA, ICA etc. are calculated from the spectral data. The number of components might be related to the number of pigments and their mixtures.

Compensation: -

26. Topic: Spatial distribution of retinal cones

Contact: Tuija Jetsu

Description: How spatial distribution of retinal cones affect on color vision.

Compensation: -

27. Topic: Optimal consideration of natural spectra

Contact: Ville Heikkinen/Jukka Antikainen

Description: To investigate natural spectra from nature and to try to find out an optimal 3-channel vision system. These channels should be compared against human vision system. It is also possible to investigate optimal system for urban society (400-1700 nm). The applicability of genetic algorithms.

Compensation: -

28. Topic: Correlation of carotenoid from Arctic Charr and spectra

Contact: Birgitta Martinkauppi

Description: Arctic charr is spectrally measured in infra-red and ultra-violet areas. These data is correlated with results from chemical analysis. The spatial variations are studied. The work is important for fish conservation.

Compensation: -

29. Topic: Spectra of welding

Contact: Ville Heikkinen

Description: Spectral "fingerprints" are used to recognize the chemical elements using for example Fourier transform.

Compensation: -

30. Topic: Determining the properties of spectral measurement devices

Contact: Jussi Kinnunen / Jouni Hiltunen

Description: Reference series is measured with all devices. Signal to noise SNR ratio and repeatability is calculated and optimal usage of a device is estimated.

Compensation: -

31. Topic: Optimal light sources fro spectral estimation

Contact: Ville Heikkinen

Description: A colour chart is imaged with a digital RGB camera under different light sources. The purpose of work is to find out an optimal set of light sources under which the sensitivities of the camera can be calculated.

Compensation: -

32. Topic: Connections between Blackbody radiators and real light sources

Contact: Ville Heikkinen

Description: The light sources in our laboratory are compared against blackbody radiator. The color temperatures and colour reproduction are studied. The presentation of light sources using blackbody radiators is investigated.

Compensation: -

33. Topic: PCA

Contact: Rainer Lenz / Ville Heikkinen

Description: Presentation of PCA components as a function of temperature.

Compensation: -

34. Topic: Analysis of Donaldson matrix

Contact: Ville Heikkinen/Jukka Antikainen/Jussi Kinnunen

Description: The Donaldson matrix (describes fluorescence) is studied using singular value decomposition and other matrix methods.

Compensation: -

35. Topic: Transmittance and reflectance of plastic plates

Contact: Jukka Antikainen

Description: Transmittance and reflectance of plastic plates is measured from 400 nm to 1700 nm.

Compensation: -

36. Topic: Properties of integrating sphere

Contact: Jouni Hiltunen

Description: The attenuation and homogeneity of spectral transmittance is measured and defined.

Compensation: -

37. Topic: Defining 3 D scanner properties

Contact: ?

Description: 3D scanner properties are investigated and distortions is studied. The accuracy of the scanner is studied as a function of distance.

Compensation: -

38. Topic: Video processing

Contact: Birgitta Martinkauppi

Description: Segmenting of videos and finding moving targets

Compensation: -

39. Topic: 3D model from video data

Contact: ?

Description: 3D model from video data

Compensation: -

40. Topic: Transmittance of leaves

Contact: Birgitta Martinkauppi

Description: The transmittance of leaves is studied as a function of temperature and UV exposure. A system for measuring need to be designed and configured.

Compensation: -