

iarigai Research Grant 2017 - Report

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DATE OF VISIT

27 August - 2 September, 2017
(5 working days)

AMOUNT AWARDED

€1480

AMOUNT CLAIMED

€1450.24

Caption: Peter Nussbaum (left)
welcomes Abhay Sharma to the NTNU
main building in Gjøvik, Norway.
Peter's bicycle is against the wall.



OVERVIEW

An application was made to iarigai for funding for Dr Abhay Sharma, Ryerson University to visit with iarigai member institution, Dr Peter Nussbaum, Norwegian University of Science and Technology, NTNU.

It was difficult to find convenient dates, due to different European and North American teaching schedules, nevertheless a great week was identified and planned from 27 August to 2, September, 2017.

Abhay flew to Oslo and then travelled to Gjøvik arriving Sunday evening. Peter provided accommodation in an on-campus residence for visiting professors and guests.

Abhay made the short walk to the Colourlab for the week and participated in discussions with faculty, student interactions, and attended and participated in a 1-day design conference. The activities of the week's visit are described below.

COURSES IN COLOUR SCIENCE

During my visit, I attended a number of relevant lecture and lab classes within the department, including - IMT4895 Specialisation in Colour Imaging, IMT6201 Colour Science and IMT4304 Cross-media Color Reproduction.

It was impressive to see the students knowledgeable and engaged with colour science material. In Jon Hardberg's class, students presented research on color-vision deficient observers, image based multi-angle measurement setup using different reflection models, stochastic capsule endoscopy image enhancement (done in conjunction with the local hospital) and discussion relating to the high dynamic range spectral imaging pipeline for multispectral cameras (which turns out is very similar to normal RGB camera systems).

In Peter Nussbaum's lab, shown here, students used ProfileMaker software to compare the results between different colorimetric datasets. Color Navigator software was also used to validate the monitor profile, and different ΔE equations were discussed. It was amazing to see that the language of colour is truly universal across the world!



MS THESIS PRESENTATION

The department has a Coloumlab and "Coloumlunch" in which different presentations are presented during Monday lunchtime. I attended Rui Jian Chu's project presentation on *Image based gonio-measurements – automation and a multispectral approach*, where he is attempting to use simple camera measurements instead of expensive commercial instruments.

The technique is used for performing multi-angle measurements of non-diffuse materials like metallic inks and paints used in the print and packaging industry and automobile paint industry.

Rui Jian Chu (shown here) is currently doing his summer internship with the Coloumlab. Chu presented his project at the Coloumlunch on August 28, 2017.



Chu is a student of Erasmus Mundus Joint Master Degree in the field of Colour in Science and Industry (COSI) under a full scholarship from the European Union. Ryerson University is planning a MSc program in package printing and it was especially relevant to understand the structure and activities of the MSc COSI program.

ABHAY'S COLOURLUNCH PRESENTATION

On Tuesday, 29 August, Abhay presented a special Coloumlab coloumlunch in which he described the North American approach to higher education. Abhay provided details about the location of Ryerson University and invited participation and collaboration in areas of colour management and colour measurement. Photo shows Abhay using a map of Canada to describe the geography of the different provinces.



PHD PROJECT REVIEW

Abhay met and had extensive discussions with PhD student - Helene Midtford (shown in photo). Helene has moved from the Oslo area to Gjøvik to undertake her research and will complete 30 credits in the first semesters, as part of her 3-year PhD program.

Another PhD student is Michael Conni, funded by Italian instrument manufacturer - Barbieri. This liaison between industry and R&D and student researchers is a "win-win" for all parties.

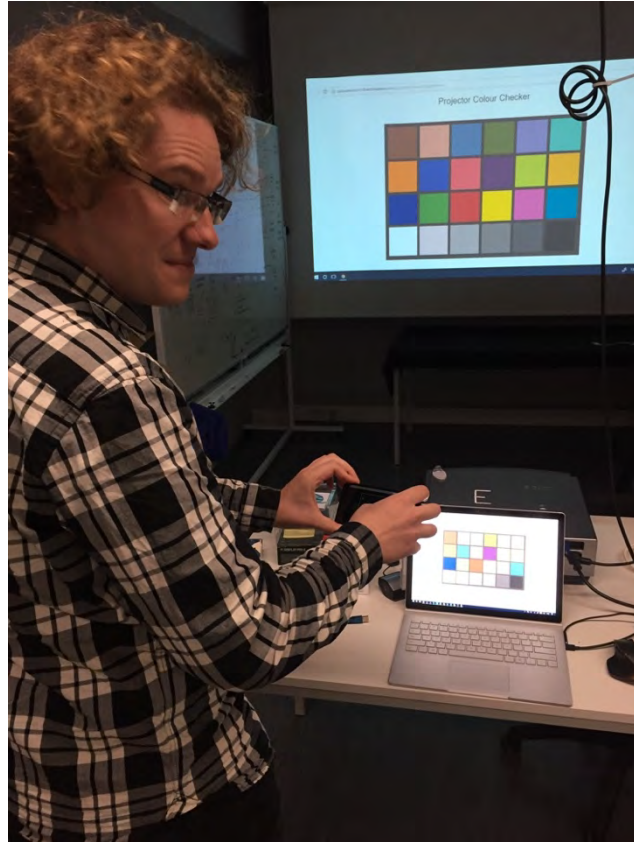
An outcome of the iarigai research grant is that the parties are considering a MITACS Norway-Canada Globalink Partnership Award in order to invite PhD students to conduct part of their projects using equipment available in North America.



POST-DOC PROJECT REVIEW

The Colourlab at NTNU has a number of research and post-doctoral projects in progress. During the week of Abhay's visit to Gjøvik, post-doctoral researcher, Dr Michael Maudere from University of Dundee was using an X-Rite i1 Display Pro and Datacolor Spyder to create an "on-the-fly" projector calibration (see photo).

In analysis of Michael's data, we discussed the difference between 3LCD and DLP projector types, including the use of a clear segment. In shared papers by Fairchild we analyzed the RGB pixel values at which the clear segment would be affected. Importantly we noted that there may be out of gamut colors in the system and that extension of the research to flat-panel displays may be relevant.



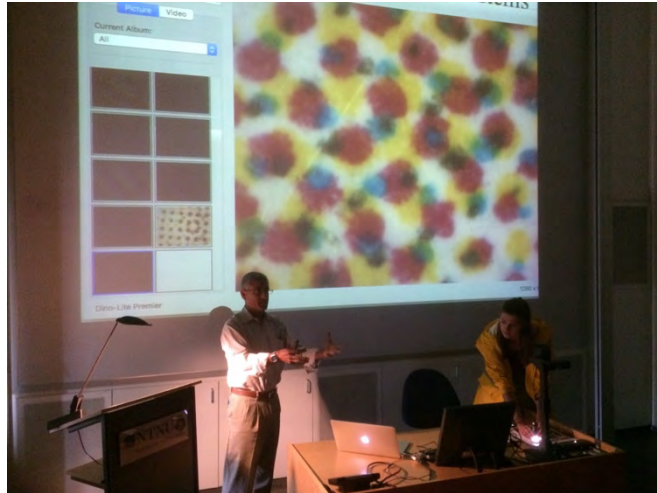
CONFERENCE PRESENTATION

It was an honor for Abhay to be invited by Prof Ole Lund to make a presentation at a one-day workshop organized by the Department of Design and the Norwegian Colour and Visual Computing Laboratory. The 1-day conference coincided with Abhay's visit dates. The conference was titled *Printing, colour, design - historical perspectives*, and was held on 31 August, 2017.

The one-day workshop was held at the Gjøvik campus and looked at the history of the major traditional printing techniques (relief, intaglio, planographic, and screen), and how the different printing techniques have used colour. The international experts included Elizabeth Savage: *Relief and intaglio colour printing techniques before the 19th century*,

Michael Twyman: *Chromolithography*, Sven Erik Skarsbø: *Advances in 20th-century offset printing technology*, Michael Twyman: *Industrial photogravure: its influence on design*, Stephen Hoskins: *A history of screen printing*, and Abhay Sharma: *Colour management for printing*.

The full program is attached to this document and the photo shows Abhay using a USB microscope to explain the halftone pattern in traditional colour printing.



SOCIAL ACTIVITIES

Within 45 minutes of Gjøvik is Lillehammer, the site of the 1994 Winter Olympics. Host Peter Nussbaum took visitor Abhay Sharma to see the site of the games and in particular to walk the whole track of the downhill ski jump. The weather in Norway at this time of the year is a perfect time to visit.



NEXT STEPS

There are a number of research topics that emerged as relevant colour management investigations. The collaborators are reviewing these topics and investigating opportunities to conduct testing and further research into these areas. The topics of interest are as follows.

- Quantification of colour reproduction in high-end flat-panel displays (e.g. BenQ and Eizo)
- Accuracy of spot colour reproduction in expanded gamut (CMYK+OGV) proofing and printing systems
- Colour management differences between 3LCD and DLP projector systems
- The use of an iPhone (or other smartphone) camera to take color measurements

Of relevance in the future collaboration is a key measuring instrument that is located at the lab in Gjøvik. The Colourlab has a telespectroradiometer for accurate measurement of emissive and transmissive colour samples called the Konica Minolta CS-1000 and also a newer model, CS-2000. This is a reference colour instrument that can measure low luminance ranges with full spectral readout and provides an independent method, with which to compare commercially available colorimeters and spectrophotometers.

Abhay and Peter have made inquiries and are considering a MITACS Norway-Canada Globalink Partnership Award that was launched by the two countries in late 2016. This new initiative is intended for collaborative research for graduate students (MSc and PhD level).

Drs Sharma and Nussbaum are preparing a joint presentation for consideration at the iarigai conference, University of Warsaw, Poland, September, 2018.

The collaborators wish to thank iarigai and the iarigai Board members for the Research Grant program and this unique travel opportunity.