Hung-Chung Li (李宏中)

Assistant Professor

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PARTICULARS

EDUCATION

National Taiwan University of Science and Technology — Taipei, Taiwan
Ph.D in Graduate Institute of Applied Science and Technology — Sep. 2013 - Jun. 2017
Advisor: Pei-Li Sun, **GPA: 3.94 / 4.0**

National Taiwan University of Science and Technology — Taipei, Taiwan
M.S in Graduate Institute of Color and Illumination Technology — Sep. 2011 - Jun. 2013
Advisor: Pei-Li Sun, **GPA: 3.90 / 4.0**

National Taiwan University of Science and Technology — Taipei, Taiwan
B.S in The Department of Electrical Engineering — Sep. 2007 - Jun. 2011
B.S in The Department of Applied Foreign Languages

RESEARCH INTERESTS

- Color Science : color imaging, color analysis, color correction, color management, color appearance model
- Imaging Technology : computer vision, digital image processing, image analysis, image quality estimation
- Artificial Intelligence (AI) : machine learning, deep learning (CNN, RNN, LSTM, GAN)
- Lighting Engineering : spectral optimization, glare evaluation, LED optics, human factor in lighting

DISSERTATION

Title: “A Study of Human Color Perception under Low Illumination Conditions for Lighting Applications”
Advisor: Prof. Pei-Li Sun

My thesis is aimed to optimize white LED spectra for low illumination conditions and verify with psychophysical experiments. In terms of light appearance modeling, a method to determine optimal parameters for the CIECAM02 color appearance model in lighting applications is proposed. An UGR-based model also is optimized for brightness estimation. The intensity of illumination, exposure time and luminance of background are the primary factors influencing characteristic of afterimage. The results not only help lighting researchers to further understand the mechanism of mesopic color vision but also provide useful knowledge and models for future lighting design.

WORK EXPERIENCE

- **Assistant Professor**
  Department of Cosmetic Science, Chang Gung University of Science and Technology, Feb. 2021 – Jul. 2023
- **Postdoctoral Research Fellow**
  Research Center of Information Technology Innovation, Academia Sinica, Nov. 2017 – Jan. 2021

- **Research Assistant**
  Comdek Industrial Corp, Taipei, Nov. 2018 – Apr. 2020
  Develop procedures to compile CERs and perform clinical literature reviews for CER

- **Consultant**
  FLEX Instruments CO., LTD, Taipei, Apr. 2020 – Present
  EPLUS Innovation Corp, Taipei, Sep. 2017 – Feb. 2020
  Technological consultancy of image processing

RESEARCH PROJECTS

- Establishing color harmony model and recommendation system for clothes matching based on deep learning. NSTC Research Project (NSTC 112-2221-E-255-001), 2023/08/01-2024/07/31.
- Establishing suitable lighting conditions and perception models for beauty aromatherapy application. MOST Research Project (MOST 111-2221-E-255-002), 2022/08/01-2023/07/31.
- Derive the Optimal Light Source for Improving Visual Color Perception of Cosmetics and an Evaluation Model based on Machine Learning. MOST Research Project (MOST 110-2222-E-255-001), 2021/06/01-2022/05/31.
- Design and Research of Smart Digital Farmer Platform, 2021 Academia Sinica Thematic Research Program (AS-TP-110 -M07), 2021/01/01-2023/12/31.
- White LED Spectral Optimization Based on 3D Gamut Volume under Mesopic Viewing Conditions, MOST Research Project (MOST 104-2221-E-011-158), 2015/08/01-2016/07/31.
- Characteristics of Afterimage Induced by Strong LED Lighting under Mesopic Conditions, MOST Research Project (MOST 103-2221-E-011-040), 2014/08/01-2015/07/31.
- To Develop a Lighting Appearance Model for Illumination Applications, NSC Research Project (NSC 102-2221-E-011-095), 2013/08/01-2014/07/31.
- Preservation of Cultural Heritage of Taiwan - Advanced Methods and Applications of Digital Conservation, the Total Appearance Reproduction and Museum Guiding System Design, MOE Aim for the Top University Plan, 2012/04/01-2012/12/31.
- Premium Design of Space Color Illumination, MOE Aim for the Top University Plan, 2011/03/01-2016/12/31.
- Proactive Technology Development and System Construction of Digital Archives-Advanced Optimizing, NSC Research Project (NSC 100-2631-H-034-002), 2011/08/01-2012/12/31.

INDUSTRIAL PROJECTS

- Color Measurement and Perceptive Model for Fluorescent Disperse Dye, Printing Technology Research Institute, MOEA Technology Development Program, TDP (RD-1070202-2), 2018/09/01-2018/12/31.
- Deep Learning Based Product Sieving from Images, Gheng Hsiu Enterprise Co., Ltd., MOST Industrial Project (MOST 107-2622-E-011-009-CC3), 2018/06/01-2019/05/31.
- Color Characteristics Comparison and Gamut Improvement of Mobile Camera, Vivo Communication Technology Co. Ltd., 2018/03/07-2018/06/06.
- Image Quality Improvement for an IR Thermometer, EPLUS Innovation Corp., 2016/11/01-2017/01/31.
- Color Analysis of Luoyang City for Color Planning, Light Whisper International Creative Strategy Co., Ltd, 2016/09/12-2016/10/11.
- Methods for Evaluating Lighting Quality of Commercial Freezers, Industrial Technology Research Institute, 2016/03/01-2016/11/30.
- Ergonomic Lighting Technology, Industrial Technology Research Institute, 2015/04/01-2015/12/16.

Hung-Chung Li

SKILLS

- Languages: English (Proficient, TOEIC:795), Japanese (Basic), Chinese (Fluent), Taiwanese (Proficient)
- Programming: Python, MATLAB, C/C++
- Toolkit: OpenCV, Keras, TensorFlow, Scikit-image, Scikit-learn, Git
- Certifications: Color Planning and Managing (Color Engineer)-Associate Level

SELECTED PUBLICATIONS

- *Journal Papers*
  - Hsin-Pou Huang, **Hung-Chung Li***, Minchen Wei, Guan-Hong Li (2023, May). Investigation of text-background lightness combination on visual clarity using a head-up display under various surround conditions and different age groups. *Applied Sciences*. (SCIE, IF:2.838)
  - **Hung-Chung Li***, Meng-Che Tsai, Tsung-Xian Lee (2022, June). A stray light detection model for VR head-mounted display based on visual perception. *Applied Sciences*. (SCIE, IF:2.838)
  - Hsin-Pou Huang, Minchen Wei, **Hung-Chung Li***, Li-Chen Ou (2021, Sep). Visual comfort of tablet devices under a wide range of ambient light levels. *Applied Sciences*. (SCIE, IF: 2.838)
  - **Hung-Chung Li** and Pei-Li Sun* (2021, Mar). Visual characteristics of afterimage under dark surround conditions. *Energies*. (SCIE, IF:3.252)
  - **Hung-Chung Li***, Pei-Li Sun, Yennun Huang and Ming Ronnier Luo (2020, May). Spectral optimization of white LED based on mesopic luminance and color gamut volume for dim lighting conditions. *Applied Sciences*. (SCIE, IF: 2.838)
  - Pei-Li Sun*, **Hung-Chung Li**, Ronnier Luo (2017, Aug). Background luminance and subtense affects color appearance. *Color Research & Application*. (SCI, IF:1.668)
  - **Hung-Chung Li***, Pei-Li Sun (2012, June). High-resolution Multispectral Image Acquisition Using Image Fusion Technology. Journal of CAGST. 359-365
- *Conference Papers*
  - **Hung-Chung Li***, Hsin-Pou Huang (2023, Dec). Optimal light sources and an evaluation model for improving the visual color perception of cosmetic colors. Optics & Photonics Taiwan, International Conference (OPTIC) 2023, Tainan, Taiwan.
  - Hsin-Pou Huang*, **Hung-Chung Li**, Hung-Wen Dao, Bo-Yu Lin (2023, Dec). Visual Comfort of a Head-up Display under Dark Condition. Optics & Photonics Taiwan, International Conference (OPTIC) 2023, Tainan, Taiwan.
  - **Hung-Chung Li***, Chun-Hsun Huang, Pei-Li Sun (2023, Jul). Establishing suitable lighting conditions and perception models for beauty aromatherapy using colored light sources. 2023 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW), Pingtung, Taiwan. (EI)
  - **Hung-Chung Li***, Chun-Hsun Huang, Pei-Li Sun (2023, Jun). Establishing suitable white light source and perception models for beauty aromatherapy application. The Sixth International Symposium on Computer, Consumer and Control (IS3C2023). (EI)
  - **Hung-Chung Li***, Hsin-Pou Huang (2022, Dec). Optimization of trichromatic white LED spectra for improving visual color perception of human skin color. Optics & Photonics Taiwan, International Conference (OPTIC) 2022, Zhongli, Taiwan.

- Hsin-Pou Huang*, **Hung-Chung Li**, Guan-Hong Li, Yao-Quan Xiw (2022, Dec). Visual Comfort of an E-Reading Device under Easy-Warm Lighting Condition. Optics & Photonics Taiwan, International Conference (OPTIC) 2022, Zhongli, Taiwan.

- Hsin-Pou Huang*, **Hung-Chung Li**, Jyun-Yi Li, Kai-Xiang Zhank (2022, Dec). White appearance of an E-device under normal office illuminance levels. Optics & Photonics Taiwan, International Conference (OPTIC) 2022, Zhongli, Taiwan.

- **Hung-Chung Li***, Zhi-Jia Yang, Chun-Ya Yang, Ting-Yu Chao, Ting-Ning Yang, Shih-Cing Li (2022, Oct). Investigation of visual color perception in cosmetics using standard light sources. The 7th Conference of Asia Color Association (ACA) 2022, Taipei, Taiwan.

- **Hung-Chung Li***, Meng-Che Tsai, Tsung-Xian Lee, Yi-Yung Chen, Pei-Li Sun (2022, Jul). Investigation of Stray Light Threshold for VR Head-Mounted Display. 2022 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW), Beitou, Taiwan. (EI)

- Chia-Yu Lee, **Hung-Chung Li**, Pei-Li Sun (2022, Apr). A method for reducing metameric color mismatch in camera-based display measurement. International Display Manufacturing Conference (IDMC) 2022, Taipei, Taiwan.

- **Hung-Chung Li***, Meng-Che Tsai, Tsung-Xian Lee, Yi-Yung Chen, Pei-Li Sun (2021, Dec). A stray light detection model for VR head-mounted display based on visual perception. Optics & Photonics Taiwan, International Conference (OPTIC) 2021, Kaohsiung, Taiwan.

- Hsin-Pou Huang*, **Hung-Chung Li**, Guan-Hong Li, Chih-Chen Yeh (2021, Dec). White Appearance of an E-reading Device under Easy Illuminance Levels. Optics & Photonics Taiwan, International Conference (OPTIC) 2021, Kaohsiung, Taiwan.

- Chia-Yu Lee, **Hung-Chung Li**, Pei-Li Sun* (2021, Dec). Minimizing Color Metamerism of Camera-based Display Measurement. Optics & Photonics Taiwan, International Conference (OPTIC) 2021, Kaohsiung, Taiwan.

- **Hung-Chung Li*** (2021, Nov). Investigation of CIE UGR and visual characteristics induced by high luminance LEDs. The 6th Conference of Asia Color Association (ACA) 2021, Yogyakarta, Indonesia

- Hsin-Pou Huang*, **Hung-Chung Li**, Minchen Wei, Li-Chen Ou (2021, Nov). White appearance for optimal text-background lightness combination document layout on a tablet display under normal light levels. In Color and Imaging Conference (Vol. 2021). Society for Imaging Science and Technology. (EI)

- Pei-Li Sun*, Yu-Ting Cheng, **Hung-Chung Li** (2021, Aug). Tone reproduction of transparent display under various background-surround conditions. The 21st International Meeting on Information Display (IMID2021), Seoul, Korea.

- **Hung-Chung Li***, Pei-Li Sun, Yennun Huang (2020, Dec). Visual characteristics of afterimage induced by LED dot matrixes. Optics & Photonics Taiwan, International Conference (OPTIC) 2020, Taipei, Taiwan.

- Hsin-Pou Huang*, **Hung-Chung Li**, Minchen Wei, Yu-Hsuan Chen, Yennun Huang (2020, Dec). A prediction model of visual comfort for an E-reading device based on machine learning. Optics & Photonics Taiwan, International Conference (OPTIC) 2020, Taipei, Taiwan.

- Yu-Ting Cheng*, **Hung-Chung Li**, Pei-Li Sun, Kuan-Ting Chen (2020, Dec). Preferred transparent display gamma under various background-surround conditions. The 27th International Display Workshops (IDW), Virtual.

- Hsuan-Chi Huang, Pei-Li Sun*, **Hung-Chung Li** (2020, Dec). Supervised learning in automatic selection of preferred inverse tone-mapping operator for HDR display. The 27th International Display Workshops (IDW), Virtual.

- Hsin-Pou Huang, Minchen Wei*, **Hung-Chung Li**, Li-Chen Ou (2020, Nov). Optimal text-background lightness combination for enhancing visual clarity using a head-up display under different surround conditions. In Color and Imaging Conference (Vol. 2020). Society for Imaging Science and Technology. (EI)

- **Hung-Chung Li***, Pei-Li Sun, Wei-Chih Su, Hung-Shing Chen, Chia-Pin Chueh, Yennun Huang (2020, Oct). Perceptual color appearance models of fluorescent samples based on machine learning. In 2020 25th Opto-Electronics and Communications Conference (OECC), IEEE, Taipei, Taiwan. (EI)

- **Hung-Chung Li***, Pei-Li Sun, Yennun Huang (2020, Sep). A mesopic lighting evaluation model based on 1D convolutional neural networks. 2020 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW), Taoyuan, Taiwan. (EI)

- **Hung-Chung Li***, Pei-Li Sun, Wei-Chih Su, Hung-Shing Chen, Chia-Pin Chueh, Yennun Huang (2020, Sep). Machine learning models to predict visual color difference of fluorescent objects under various illumination conditions. 2020 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW), Taoyuan, Taiwan. (EI)

- **Hung-Chung Li***, Pei-Li Sun, Yennun Huang (2020, Jul). Optimization of trichromatic white LED spectra for dim lighting condition. 5th CIE Expert Symposium on Colour and Visual Appearance, Hong Kong, China.

- **Hung-Chung Li*,** Yennun Huang, Pei-Li Sun (2019, Dec). Optimization of trichromatic white LED spectra for mesopic vision using SPDs of a Color Blast. Optics & Photonics Taiwan, International Conference (OPTIC) 2019, Taichung, Taiwan.

- **Hung-Chung Li***, Pei-Li Sun, Yennun Huang (2019, Nov). A DNN-based model for CIECAM02 application. The 5th Conference of Asia Color Association (ACA) 2019, Japan, Nagoya.

- Pei-Li Sun*, Wei-Chih Su, Hung-Shing Chen, **Hung-Chung Li** (2019, Nov). A low-cost method to predict color appearance of fluorescent samples under various illumination conditions. The 5th Conference of Asia Color Association (ACA) 2019, Japan, Nagoya.

- **Hung-Chung Li***, Yennun Huang, Pei-Li Sun (2018, Dec). A Comparison of Optimal White LED Spectra under Mesopic Condition. Optics & Photonics Taiwan, International Conference (OPTIC) 2018, Tainan, Taiwan.

- **Hung-Chung Li***, Shang-Chih Lin, Yu Tsao, Shun-Feng Su, Pei-Li Sun and Yennun Huang (2018, Nov). A Supervised Learning Algorithm Considering Light Conditions for Visual Inspection of Metal Objects. The 2018 International Symposium of Quality Management (ISQM), Taichung, Taiwan. (**honorable mention award**)

- **Hung-Chung Li***, Pei-Li Sun, Ronnier Luo (2016, Dec). Optimal White LED Spectrum for Pattern Recognition under Mesopic Condition. International Display Workshops (IDW), Japan, Fukuoka.

- Yuan-Peng Pi*, Pei-Li Sun, Hsin-Ping Chien, **Hung-Chung Li** and Yun-Cian Su (2016, Dec). Colorizing 3D Objects in Free-viewpoint through a Transparent LCD. International Display Workshops (IDW), Japan, Fukuoka.

- **Hung-Chung Li***, Pei-Li Sun, Ronnier Luo (2016, Sep). Optimization of White LED Spectrum under Mesopic Condition Based on 3D Color Gamut. 4th CIE Symposium on Colour and Visual Appearance, Prague, Czech Republic.

- **Hung-Chung Li***, Pei-Li Sun, and Ronnier Luo (2015, Dec). Visual Characteristics of Afterimage under Dark Surround Conditions. International Display Workshops (IDW), Japan, Otsu.

- Yun-Chien Su*, Pei-Li Sun, **Hung-Chung Li** and Wei-Chun Hung (2015, Dec). An adaptive Color Calibration Method for LCDs in Different Display Modes. International Display Workshops (IDW), Japan, Otsu.

- **Hung-Chung Li***, Pei-Li Sun, and Ronnier Luo (2015, Dec). The Duration and Visibility of Afterimage Induced by Color LEDs under Dark Viewing Conditions. Optics & Photonics Taiwan, International Conference (OPTIC) 2015, Hsinchu, Taiwan.

- Po-Li Chen, Chun-Hsiang Liao*, **Hung-Chung Li**, Shyh-Jye Jou, Han-Ting Chen, Yu-Hsin Lin, Yu-Hsiang Tang et al (2015, Jul).. "A portable inspection system to estimate direct glare of various LED modules." In International Conference on Optical and Photonic Engineering (icOPEN2015), vol.9524, p.95241X. International Society for Optics and Photonics, 2015.

- **Hung-Chung Li***, Pei-Li Sun, Shu-Yun Chang, and Ronnier Luo (2014, Dec). Predicting Color Appearance under Non-uniform Lighting Environments. International Display Workshops (IDW), Japan, Niigata.

- **Hung-Chung Li***, Pei-Li Sun (2014, Sep). The Effects of Non-uniform Surround on Brightness Estimation. The 2nd Conference of Asia Color Association (ACA) 2014, Taipei, Taiwan.

- Pei-Li Sun*, **Hung-Chung Li** and Phil Green (2013, Dec). Evaluating CIE Unified Glare Rating of a Scene Using a Panoramic Camera. International Display Workshops (IDW), Sapporo Convention Center, Sapporo.

- Pei-Li Sun*, **Hung-Chung Li** and Phil Green (2013, Jul). Estimating CRIs using a Calibrated Digital Camera. International Color Association (AIC) 2013, England.

- **Hung-Chung Li***, Pei-Li Sun, Phil Green (2012, Sep). Evaluating Color Appearance and Visual Comfort of a Living Environment Using a Panoramic Camera. Interim Meeting of the International Color Association (AIC) 2012, Taipei, Taiwan.