**ENGN8501 2021S2 Weekly Study Plan (a living Google-Doc)**

Selected Topics in Computer Vision

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| **#Week** | **Topics** | **In-class reading**  **( Monday lecture time )** | **Home-reading papers.** | **Tutorial session (Thursday)** | **Reading Report** | **Research Project** | **Comment** |
| 1  (26th July) | Introduction  Low-level vision  Image defocus blur | [PSF estimation using sharp edge prediction](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjI75an8vLxAhVxILcAHZtADXUQFjAAegQIBxAD&url=http%3A%2F%2Fvision.ucsd.edu%2Fsites%2Fdefault%2Ffiles%2Fpsf_estimation.pdf&usg=AOvVaw2NBNt6m2bkssoDwF_2DUOi), N. Joshi et al. CVPR  [Image pre-conditioning for out of focus projector blur,](http://www.cse.yorku.ca/~mbrown/pdf/cvpr06_brown.pdf) M.Brown et al. CVPR 06  [**How to read a paper**](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj74-Pk8vLxAhVT83MBHcnADO8QFjACegQIBhAD&url=https%3A%2F%2Fweb.stanford.edu%2Fclass%2Fee384m%2FHandouts%2FHowtoReadPaper.pdf&usg=AOvVaw21jcwtqxu42RtFW2UbDtWO)**, by S. Keshav.**  [**How to get your SIGGRAPH paper rejected**](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi2uPrY8vLxAhW88HMBHW6KCTQQFjAAegQIBRAD&url=https%3A%2F%2Fwww.siggraph.org%2Fsites%2Fdefault%2Ffiles%2Fkajiya.pdf&usg=AOvVaw3SebVMXN9ltCLeUnjbB3R0)**, by Jim Kajiya.** | Single image spatially variant out-of-focus blur removal, S. Chan, et al. IEEE ICIP 2011.  Blind image super-resolution with spatially variant degradations, V. Cornillere, et al.  Controllable image restoration for under-display cameras in smartphones, K. Kwon, et al. CVPR 2021.  Fast, accurate, and lightweight super-resolution with cascading residual network, N. Ahn, et al. ECCV 2018. | No tutorial in the first week. |  |  |  |
| 2 | Camera motion blur  Camera shaking (w/wo IMU) | [Image deblurring using Inertial Measurement sensors](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjq45r68vLxAhX5H7cAHX6LAkoQFjACegQIBxAD&url=https%3A%2F%2Fwww.microsoft.com%2Fen-us%2Fresearch%2Fwp-content%2Fuploads%2F2016%2F02%2Fimu_deblurring.pdf&usg=AOvVaw2ynaaqIbrKaCzZ5Cn2WFE8), N. Joshi, et al.  [Image deblurring using smartphone Inertial sensors](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiDtpqJ8_LxAhVX73MBHXncA14QFjABegQICBAD&url=https%3A%2F%2Ffaculty.ucmerced.edu%2Fmhyang%2Fpapers%2Fcvpr16_mobile_deblurring.pdf&usg=AOvVaw3Jdu22OXexFueW2nQCRR1W), Zhe Hu, et al.  [Removing camera shake from a single photograph](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwix-J6V8_LxAhUM7XMBHYoKAk8QFjAAegQIBRAD&url=http%3A%2F%2Fpeople.csail.mit.edu%2Fbillf%2Fpublications%2FRemoving_Camera_Shake.pdf&usg=AOvVaw1fLYnmnmVy_CDu1qE7UWl3), R. Fergus, et al. SIGGRAPH. | Removing partial blur in a single image, S. Dai, CVPR 2008  Deep video deblurring for hand-held cameras, S. Su, et al, CVPR.  Towards digital refocusing from a single photograph, Y. Bando, et al. MIT  Learning Deep CNN Denoiser Prior for Image Restoration, Kai Zhang1,2, Wangmeng Zuo1,∗, Shuhang Gu2, Lei Zhang2, CVPR 2017.  [I*mage restoration* in *astronomy*: a *Bayesian* Perspective,](https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=916318) by ‎Molina , IEEE SPM | Tute: Paper Reading and discussion:    On image deblur, blur removal, image super-resolution.  **( Duty Tutor: Huiyu )** |  |  |  |
| 3 | Computational Photography  Coded aperture  Coded shutter | Image and depth from a conventional camera with a coded aperture, A. Levin, et al.  Coded aperture pairs for depth from defocus, C. Zhou, et al.  Coded Exposure Photography: Motion Deblurring using Fluttered Shutter, R. Raskar, et al. | What are Good Apertures for Defocus Deblurring?, C. Zhou, et al.  Computational Photography: Epsilon to Coded Photography, R. Raskar, et al.  Image deblur with blurred/noisy image pairs, L. Yuan, et al. SIGGRAPH | Tute: Free Q&A tutorial session.  **( Duty tutor: Huiyu )** | Report-1 due:  (Marking: **Huiyu and Tianyu,** share the load and ensure consistency between marks.) | Project starts |  |
| 4 | Natural image matting  Camera depth of field (bokeh effect) | Alpha Estimation in Natural Images, M. Ruzon, et al.  A Bayesian Approach to Digital Matting, Y. Chuang, et al.  Background Matting: The World is Your Green Screen, S. Sengupta, et al.  Synthetic Depth-of-Field with a Single-Camera Mobile Phone, N. Wadhwa, et al. | A Closed Form Solution to Natural Image Matting, A. Levin, et al.  Real-Time High-Resolution Background Matting, S. Lin, et al.  Rendering Natural Camera Bokeh Effect with Deep Learning, A. Ignatov, et al.  DeepLens: Shallow Depth Of Field From A Single Image, L. Wang, et al. | Tute : Paper reading and discussion:  A Closed Form Solution to Natural Image Matting, A. Levin, et al.  **( Duty Tutor: Sahir )** |  |  |  |
| 5 | Physics-based vision  Photometric stereo | **Uncalibrated Near-Light Photometric Stereo,**  by Thoma Papadhimitri and Paolo Favaro, BMVC 2014.  Photometric via Computer Screen Lighting for Real-time Surface Reconstruction, G. Schindler, et al.  Outdoor Photometric Stereo, L. Yu, et al. | Photometric stereo using LCD displays,  J. Clark, et al  Lightweight Photometric Stereo for Facial Details Recovery, X. Wang, et al.  PS-FCN: A Flexible Learning Framework for Photometric Stereo, G. Chen, et al.  PX-NET: Simple and Efficient Pixel-Wise Training of Photometric Stereo Networks, F. Logothetis, et al. | Tute: Paper reading and discussion  (Photometric stereo)  Lightweight Photometric Stereo for Facial Details Recovery, X. Wang, et al.  **( Duty Tutor: Huiyu )** | Report-2 due:  (Marking : **Huiyu and Sahir,**  share the load and ensure consistency between marks.) | **Project proposal due:**  One page PDF in CVPR format.  ( Late change of topic will result in a minus-5 mark penalty).  Project check-point  (project proposal: you must have determined on the paper). |  |
| 6  (30th August-- 5th September) | Photograph Relighting | Deep Single-Image Portrait Relighting, H. Zhou, et al.  Single Image Portrait Relighting, T. Sun, et al | SfSNet: Learning Shape, Reflectance and Illuminance of Face ‘in the wild’, S. Sengupta, et al.  Total Relighting: Learning to Relight portraits for Background Replacement, R. Pandey, et al.  Self-supervised Outdoor scene Relighting, Y. Yu, et al. | Tute: Python refresher and PythonTroch prime (on a normal CPU).  How to configure DUG/GPU:  & Pytorch on GPU (DUG).  **( Duty Tutors: Tianiyu and Sahir )** |  |  |  |
| Teaching  Break-A  (6thSept.) | Work on your project |  |  | No tute. |  | Work on your project |  |
| Teaching  Break-B | Work on your project |  |  | No tute. | Report-3 due:  (Marking : **Tianyu,**  **Sahir ,**  share the load and ensure consistency between marks.) | Work on your project |  |
| 7  (20th Sept.) | Human pose and shape  2D pose  3D pose  3D body shape fitting | Deep learning based 2D human pose estimation, a survey, Qi Dang, et al, Tsinghua science and technology, 2019.  Detailed human shape and pose from images, Balan, et al, CVPR  Keep it SMPL: automatic estimation of 3D human pose and shape from single image, Bogo, et al, ECCV. | Fast human pose estimation, Feng Zhang, et al. CVPR  Unsupervised geometry-aware representation for 3D human pose estimation, H. Rhodin, etl al, ECCV.  Learnable triangulation of human pose. Karim Iskakov, et al.  SMPL: a skinned multi-person linear model, M. Loper et al.  Learning to reconstruct 3D human pose and shape via mode-fitting in the loop, N. Kolotouros, et al. 2019.  Everybody dance now. C Cha. et al, ICCV. | Tute: paper reading and discussion:  ( on human pose )  **Duty tutor: Tianyu.**  (TBA: in addition: we may invite Weimao to give one presentation ). |  |  |  |
| 8 | Graphical model (A)  MRF, ICM, mean-fields    Message passing and Loop BP  (Guest lecturer: Dr. Zhiwei Xu) | Graphical models, Bishop, PRML book, Chapter 8.  Graphical models and belief propagation, B. Freeman, et al. (lecture 7)  Loopy Belief Propagation in Image-Based Rendering, D. Sharon, et al. | Markov random fields and Gibbs sampling for image denoising, Chang Yue, project report.  Efficient Belief Propagation for Early Vision, P. Felzenszwalb, et al. ICCV  Applications of the mean field methods to MRF optimization in computer vision, M. Saito. et al. CVPR 2012. | Tute-7:  Project checkpoint (free Q&A session).  **Duty Tutors: Tianyu, and Sahir** |  | Project checkpoint |  |
| 9  (4th October)  Labor day holiday on Monday.  Lecture shifted to Thursday | Graphical model (B)  Max flow and Graph-cut  (Guest lecturer: Dr. Zhiwei Xu) | *Graph cut matching in computer vision, Toby Collins, project report, 2004.*  Graph Cuts in vision and graphics: theories and applications, Y. Boykov and Olga Veskler. 2006.  GrabCut:Interactive Foreground Extraction using Iterated Graph Cuts, Carsten Rother∗ Vladimir Kolmogorov† Andrew Blake‡ Microsoft Research Cambridge, UK | *Fast approximate Energy minimization via graph cuts, Y. Boykov, et al.*  Interactive organ segmentation using graph cuts, Y. Boykov et al.  *Interactive Graph Cuts* for Optimal Boundary and Region Segmentation of Objects in N-D Images, Y. Boykov, et al.  Graphcut Textures: Image and Video Synthesis Using Graph Cuts  [Vivek Kwatra](http://www.cc.gatech.edu/%7Ekwatra/) , et al. [SIGGRAPH 2003](http://www.siggraph.org/s2003/).  Interactive Digital Photomontage,Aseem Agarwala, SIGGRAPH 2004.  Digital Tapestry, Carsten Rother 1 Sanjiv Kumar 2, CVPR 2005. | Tute-8:  Paper reading and discussion:  (on graph cut)  **Duty Tutor: Zhiwei ?**  Interactive Digital Photomontage,Aseem Agarwala, SIGGRAPH 2004.  Comparison of graph-cuts with belief propagation for stereo, using identical MRF parameters. Tappen et al. | Report-4 due:  (Marking : **Sahir and Tianyu,**  share the load and ensure consistency between marks.) |  |  |
| 10 | Indoor scene understanding  Room layout ;  (Guest lecturer: Dr Miaomiao Liu ) | Indoor scene parsing with instance segmentation, semantic labelling, and support relationship inference. Wei Zhuo, et al.  Room-Net: end-to-end room layout estimation, C. Lee, et al. ICCV.  LayoutNet: reconstructing the 3D room layout from a single RGB image, C. Zou, et al. CVPR | 3D room layout estimation from a single RGB image, Chenggang Yan, et al. IEEE.  General 3D room layout from a single view by render-and-compare, Stekovic, et al. ECCV.  A coarse-to-fine indoor layout estimation (CFILE) method. Y. Ren, et al. ECCV.  Automatic semantic modelling of indoor scenes from low-quality RGB-D Data using contextual information, Kang Chen,et al.  Holistic 3D scene understanding from a single image with implicit representation, C. Zhang et al, CVPR 2021. | Tute: Project-checkpoint:  (On Duty: All tutors and lecturer) |  | Project checkpoint |  |
| 11 | 3D object fitting; IKEA | Parsing IKEA Objects: fine pose estimation, J. Lim. et al.  Single image 3D interpreter network. J. Wu et al. | Pix3D: Dataset and Methods for single-image 3D Shape Modeling, X. Sun et al.  MarrNet: 3D Shape Reconstruction via 2.5D Sketches, Jiajun Wu, et al. NIPS.  Total 3D Understanding: joint layout, object pose and mesh reconstruction for indoor scenes from a single image. Y. Nie et al.  FroDO: From Detections to 3D Objects, Martin Runz, et al. Facebook.  Bird of a feather: Capturing Avian Shape models from images, Y. Wang et al. CVPR 2021 | Tute: Paper reading and discussion:  (on 3D object, scene understanding)  Bird of a feather: Capturing Avian Shape models from images, Y. Wang et al. CVPR 2021.  **Duty Tutor: Tianyu.** |  |  |  |
| 12  (25th October) | Outdoor (road) scene understanding;  Autonomous Driving | Fast Scene understanding for autonomous driving, D. Neven, et al.  Are we ready for autonomous driving? The KITTI Vision benchmark suite, A. Geiger et al.  The Oxford Road boundaries dataset. Suleymanov, et al.  LaneAF: robust multi-lane detection with affinity fields. Abualsaud et al.  HD-maps: fine-grained road segmentation by parsing ground and aerial images. G. Mattyus, et al. | No home reading in week-12. | We may use the 4 hours tutorial time for seminar presentations.  **On Duty: All Tutors.** | Report-5 due;  **Marking: Sahir and Huiyu,** check with other tutors to ensure consistency. | Seminar Presentation due:  Marking all presentations.  (**All Tutors**) |  |
| Exam week |  |  |  |  |  | Project Report (and source code) due.  **Marking: all tutors, sharing the load.** |  |