GWANGBIN BAE

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🎓 EDUCATION

Oct 2019 - Apr 2023	**PhD in Computer Vision** University of Cambridge › Supervised by Prof. Roberto Cipolla (Machine Intelligence Laboratory) › **Thesis :** Learning Monocular Cues in 3D Reconstruction
Oct 2018 - Sep 2019	**MPhil in Machine Learning and Machine Intelligence** University of Cambridge › **Commendation** (final mark : 73/100) › **Dissertation :** Approximate Depth Estimation in Colonoscopy Images
Sep 2012 - Aug 2015	**BSc in Physics** King's College London › **First class honours** (final mark : 84/100) › **Third-year project :** Evaluation of Various Models of Cosmological Inflation Based on the New Planck Result

💼 EXPERIENCES

Apr 2023 - Present	**Postdoctoral Researcher** Dyson Robotics Lab, Imperial College London › Supervised by Prof. Andrew J. Davison › Exploring the usefulness of monocular cues in 3D computer vision
Apr 2022 - Jun 2022	**Research Intern** Microsoft - Mixed Reality & AI Lab › Investigated the usefulness of synthetic data in various face analysis tasks › Created a synthetic dataset for face recognition by generating and rendering digital faces
Oct 2019 - Oct 2020	**Research Intern** NISI HK › Developed monocular/multi-view depth estimation methods for colonoscopy images › Delivered multiple technical presentations at technology forums and workshops
Jul 2017 - Apr 2018	**Machine Learning Developer** Precycler › Designed an autonomous recycling bin that can sort the incoming garbage based on sound › Developed garbage classification algorithms based on MFCC analysis and machine learning
Oct 2015 - Jul 2017	**Assistant Drill Instructor & Squad Leader** ROK Army - 50th Infantry Division › Instructed new recruits in basic combat skills including riflemanship and hand grenade › Awarded two Meritorious Service Medals for distinguished performance
Jul 2014 - Aug 2014	**Research Intern** King's College London › Conducted a research on Quirks (imaginary particles introduced to explain the missing mass problem) › Constructed computer simulations to generate Quirks collisions under varying conditions

📖 Publications

CVPR 2024
Oral (top 0.8%)

Rethinking Inductive Biases for Surface Normal Estimation
Gwangbin Bae, *Andrew J. Davison*
> In this paper, we discuss the inductive biases needed for surface normal estimation and propose to (1) utilize the per-pixel ray direction and (2) estimate the surface normals by learning the relative rotation between nearby pixels.

CVPR 2024

SuperPrimitive : Scene Reconstruction at a Primitive Level
Kirill Mazur, Gwangbin Bae, *Andrew J. Davison*
> Should the complexity of 3D reconstruction tasks be dependent on # of pixels or # of "things" in the image? We use surface normal and segmentation priors to split the image into 2.5D segments and show how this representation can help tackle a wide range of 3D reconstruction tasks

WACV 2024

FOUND : Foot Optimization with Uncertain Normals for Surface Deformation Using Synthetic Data
Oliver Boyne, Gwangbin Bae, *James Charles, Roberto Cipolla*
> Monocular surface normals and their uncertainty can be used to fit a generative 3D model. We demonstrate this for the case of the human foot, which can be useful for commercial applications like virtual shoe try-on.

WACV 2023

DigiFace-1M : 1 Million Digital Face Images for Face Recognition
Gwangbin Bae, *Martin de La Gorce, Tadas Baltrušaitis, Charlie Hewitt, Dong Chen, Julien Valentin, Roberto Cipolla, Jingjing Shen*
> We introduce a synthetic dataset for face recognition in order to tackle the problems associated with the existing datasets obtained by collecting millions of real face images without explicit consent. This work was done during my internship at Microsoft Mixed Reality & AI Lab in Cambridge.

BMVC 2022

IronDepth : Iterative Refinement of Single-View Depth Using Surface Normal and Its Uncertainty
Gwangbin Bae, *Ignas Budvytis, Roberto Cipolla*
> We use surface normal to propagate depth between pixels and formulate depth refinement/upsampling as a classification of choosing the neighboring pixel to propagate from.

BMVC 2022

SPARC : Sparse Render-and-Compare for CAD Model Alignment in a Single RGB Image
Florian Langer, Gwangbin Bae, *Ignas Budvytis, Roberto Cipolla*
> SPARC aligns CAD models to the objects in the image by iteratively updating their 9DoF pose. This is done by rendering sparse points from the CAD model and comparing their depth/normal to the depth/normal estimated from the image.

CVPR 2022

Oral (top 4.2%)

Multi-View Depth Estimation by Fusing Single-View Depth Probability with Multi-View Geometry
Gwangbin Bae, *Ignas Budvytis, Roberto Cipolla*
> We estimate single-view depth probability distribution and use it to sample per-pixel depth candidates and to ensure that the multi-view depth is consistent with the single-view predictions.

ICCV 2021
Oral (top 3.4%)

Estimating and Exploiting the Aleatoric Uncertainty in Surface Normal Estimation
Gwangbin Bae, *Ignas Budvytis, Roberto Cipolla*
> We estimate the aleatoric uncertainty in surface normal estimation and use it to improve the quality of prediction on small structures and near object boundaries.

MICCAI 2020

Deep Multi-View Stereo for Dense 3D Reconstruction from Monocular Endoscopic Video
Gwangbin Bae, *Ignas Budvytis, Chung-Kwong Yeung, Roberto Cipolla*
> We propose a deep learning-based multi-view stereo pipeline for endoscopic images.

🏆 Awards

2022	**Rank Symposium on Neural Rendering in Computer Vision - Best student presentation** Title : Improving Monocular 3D Reconstruction Using Surface Normal and Its Uncertainty
2018	**Kwanjeong Educational Foundation Scholarship (30,000 USD)** Awarded to talented Korean students studying in international universities
2017	**SK National Start-Up Competition - Grand Prize (1st Place)** Presented the project on Precycler (autonomous recycling bin)
2015	**Nikon Prize for a Physics Project** Best third-year project
2014	**Nikon Prize for Laboratory Physics** Best performance in laboratory physics
2014	**Gordon Rogers Scholarship (3,000 GBP)** Awarded to five best second-year physics students
2012	**25th International Young Physicists' Tournament - Gold Medal (1st Place)** Participated as Korean team coach - supervised national team members conducting research on 17 topics
2011	**24th International Young Physicists' Tournament - Gold Medal (1st Place)** Participated as Korean team captain

💡 Talks

	Monocular cues : Always-on perception for 3D computer vision
27 Mar 2024	*ETH Zurich - Prof. Marc Pollefeys' group*
27 Mar 2024	*ETH Zurich - Prof. Konrad Schindler's group*
26 Mar 2024	*Google Zurich*
	Single-image surface normal estimation methods and their usefulness
28 Dec 2023	*Seoul National University - Prof. Young Min Kim's group*
	Improving monocular 3D reconstruction using surface normal and its uncertainty
17 Oct 2022	*Imperial College London - Prof. Andrew Davison's group*
28 Sep 2022	*Toshiba Europe's Cambridge Research Laboratory*
19 Sep 2022	*Technical University of Munich (TUM) - Prof. Angela Dai's group*
16 Sep 2022	*Pohang University of Science and Technology (POSTECH) - Prof. Tae-Hyun Oh's group*
10 Aug 2022	*Rank Symposium - Neural Rendering in Computer Vision*
	Estimating and exploiting the aleatoric uncertainty in surface normal estimation
22 Dec 2021	*Hanyang University BK21 seminar*