Jishnu Mukhoti

DPhil(PhD) Candidate in Torr Vision Group & OATML, University of Oxford
Wolfson College, Linton Road, Oxford, United Kingdom OX2 6UD
+44 7948048769 jishnu.mukhoti@eng.ox.ac.uk jishnu-mukhoti-9208b79a omegafragger

Research Interests & Experience

1. Uncertainty quantification, calibration and robustness of neural networks with applications in computer vision
2. Multi-modal foundation models

Education

University of Oxford **Oct. 2019 - Present**
DPhil(PhD) in Engineering Science (Focusing on Machine Learning) *Oxford, UK*

- **Thesis Supervisors:** Prof. Philip H.S. Torr & Prof. Yarin Gal
- Fully funded by a Research Studentship from the Department of Engineering Science, University of Oxford.

University of Oxford **Oct. 2017 - Sept. 2018**
MSc in Computer Science (Focusing on Machine Learning) *Oxford, UK*

- **Thesis Supervisor:** Prof. Yarin Gal.
- **Thesis:** Benchmarks on Bayesian Deep Learning in Image Segmentation
- Graduated with distinction.

Jadavpur University **June 2012 - May 2016**
BE (Bachelor of Engineering) in Computer Science & Engineering *Kolkata, India*

- **CGPA:** 9.65/10, University Topper & Gold Medalist, First Class with Honours

Featured Research Projects

Open-World Computer Vision with Multi-modal Models (Ongoing)

Meta AI (FAIR) & Torr Vision Group *New York City, USA*

- Designed compatibility function for contrastive loss to achieve token level alignment between multi-modal encoders.
- Resulting models can zero-shot transfer to classification, semantic and reference segmentation in an open-vocabulary setting without requiring any task-specific annotations.
- Resulting models also show higher robustness to distribution shift.
- Paper: **Open Vocabulary Semantic Segmentation with Patch Aligned Contrastive Learning** (`arxiv:2212.04994`), ***highlight in CVPR, 2023.***

Deep Deterministic Uncertainty (DDU)

OATML & Torr Vision Group *Oxford, UK*

- Developed a way of quantifying epistemic and aleatoric uncertainty reliably from deterministic models.
- DDU beats state-of-the-art deep ensembles in OoD detection with a single deterministic model.
- Paper: **Deep Deterministic Uncertainty: A Simple Baseline** (`arxiv:2102.11582`), ***highlight in CVPR, 2023.***
- Code: `github.com/omegafragger/DDU`

Focal Calibration

Oxford Research Group, FiveAI & Torr Vision Group *Oxford, UK*

- Analysed NLL overfitting as the primary cause of miscalibration in deep neural networks.
- Studied properties of an alternative loss function, focal loss, which can be used to train well-calibrated neural networks as compared to the cross-entropy objective.
- Paper: **Calibrating Deep Neural Networks using Focal Loss** (`arxiv:2002.09437`), ***published in NeurIPS, 2020.***
- Code: `github.com/torrvision/focal_calibration`
- Blog: `torrvision.com/focal_calibration`

Raising the Bar on OoD Evaluation

Meta AI (FAIR) & Torr Vision Group *Oxford, UK*

- Defined different types of OoD using the concepts of semantic and perceptual similarity to in-distribution samples.
- Developed a GAN generative model to generate the different types of OoD from the training distribution.
- The generated OoD provide a significantly stronger benchmark compared to conventional OoD evaluation benchmarks.
- Paper: **Raising the Bar on the Evaluation of OoD Detection** (`arxiv:2209.11960`)

Publications

1. Jishnu Mukhoti, Tsung-Yu Lin, Omid Poursaeed, Rui Wang, Ashish Shah, Philip Torr, Ser-Nam Lim, *Open Vocabulary Semantic Segmentation with Patch Aligned Contrastive Learning*, in CVPR, 2023 (highlight).

2. Jishnu Mukhoti*, Andreas Kirsch*, Joost van Amersfoort, Philip Torr, Yarin Gal, *Deep Deterministic Uncertainty: A Simple Baseline*, in CVPR, 2023 (highlight).

3. Jishnu Mukhoti*, Viveka Kulharia*, Amartya Sanyal, Stuart Golodetz, Philip Torr, Puneet Dokania, *Calibrating Deep Neural Networks using Focal Loss*, in NeurIPS, 2020.

4. Jishnu Mukhoti, Joost van Amersfoort, Philip Torr, Yarin Gal, *Deep Deterministic Uncertainty for Semantic Segmentation*, ICML 2021 Workshop on Uncertainty & Robustness in Deep Learning (UDL).

5. Andreas Kirsch, **Jishnu Mukhoti**, Joost van Amersfoort, Philip Torr, Yarin Gal, *On Pitfalls in OoD Detection: Entropy Considered Harmful*, ICML 2021 Workshop on Uncertainty & Robustness in Deep Learning (UDL).

6. Jishnu Mukhoti*, Viveka Kulharia*, Amartya Sanyal, Stuart Golodetz, Philip Torr, Puneet Dokania, *On using Focal Loss for Neural Network Calibration*, in ICML 2020 Workshop on Uncertainty & Robustness in Deep Learning (UDL).

7. Jishnu Mukhoti, Tsung-Yu Lin, Borchun Chen, Ashish Shah, Philip Torr, Puneet Dokania, Ser-Nam Lim, *Raising the Bar on the Evaluation of OoD Detection*, arXiv:2209.11960.

8. Jishnu Mukhoti, Yarin Gal, *Evaluating Bayesian Deep Learning Methods for Semantic Segmentation*, arXiv:1811.12709.

9. Jishnu Mukhoti, Pontus Stenetorp, Yarin Gal, *On the Importance of Strong Baselines in Bayesian Deep Learning*, in NeurIPS 2018 Workshop on Bayesian Deep Learning.

10. Jishnu Mukhoti, Puneet Dokania, Philip Torr, Yarin Gal, *On Batch Normalisation for Approximate Bayesian Inference* in the 3rd Symposium on Advances in Approximate Bayesian Inference, 2021.

11. Diptendu Bhattacharya, **Jishnu Mukhoti**, Amit Konar, *Learning Regularity in an Economic Time-Series for Structure Prediction*, in Elsevier, Applied Soft Computing, 2019.

12. Jishnu Mukhoti, Pratyusha Rakshit, Diptendu Bhattacharya, Amit Konar, Atulya Nagar, *Knowledge Extraction from a Time-Series using Segmentation, Fuzzy Matching and Predictor Graphs*, in IEEE Conference on Fuzzy Systems (FUZZ-IEEE), 2016.

13. Jishnu Mukhoti, Sukanya Dutta, Ram Sarkar, *Handwritten Digit Classification in Bangla and Hindi using Deep Learning*, in Taylor & Francis, Applied Artificial Intelligence, 2020.

Industry Experience

Meta AI Research **Jun 2022 - Sept 2022**
Research Scientist Intern *New York City, USA*

- ***Project:*** Open-World Computer Vision with Multi-modal Models (hosted by Tsung-Yu Lin & Ser-Nam Lim)

Meta AI Research **Jun 2021 - Sept 2021**
Research Scientist Intern *Remote*

- ***Project:*** Raising the Bar on the Evaluation of OoD Detection (hosted by Tsung-Yu Lin & Ser-Nam Lim)

FiveAI **Aug 2018 - Aug 2019**
Research Scientist Intern *Oxford, UK*

- ***Project:*** Calibration in deep neural networks with application in autonomous driving (hosted by Stuart Golodetz & Puneet Dokania)

Amazon **June 2016 - Aug 2017**
Software Development Engineer (SDE) *Hyderabad, India*

- ***Project:*** Real-time data transfer service from OLTP datastores (AWS RDS and DynamoDB) to OLAP datastores (AWS Redshift and Elasticsearch), designed layered architecture for services for modularity and fault tolerance.

Amazon **May 2015 - July 2015**
Software Development Engineer (SDE) Intern *Hyderabad, India*

- ***Project:*** Real-time validation engine to automate the validation of critical database records, reduced validation time from 2000 records per week to less than 10 seconds.

Honors & Awards

Scholarships

- **Oxford Research Studentship**, supports my ongoing DPhil (PhD) by fully covering my tuition and living expenses.
- **Goa Education Trust Scholarship, British Council**, covered the tuition feed for my MSc in Computer Science in the University of Oxford.
- **INSPIRE Scholarship**, awarded to the top 1% of the students in the 12th standard Board Examinations (Indian School Certificate Examinations).

Awards

- **Amazon Excellence Award (Deep-Dive, Learn & Be Curious, Ownership)**, awarded for independently designing and implementing a method for near real-time incremental data transfer from primary databases to a data warehouse.
- **University Gold Medal**, awarded for securing the highest CGPA in Jadavpur University for the 2012-2016 batch.
- **University Best Project Award** for best Bachelor's thesis in the 2012-2016 batch.
- **Indu Bhusan Putatunda and Shanti Sudha Putatunda Memorial Award** awarded by the Alumni Association of Jadavpur University for securing the highest CGPA in the Department of Computer Science and Engineering.

Conferences & Talks

- **Talk at FiveAI, Oxford**, *Open Vocabulary Semantic Segmentation with Patch Aligned Contrastive Learning*, 2023
- **Talk at École Polytechnique de Montréal**, *Scalable Uncertainty Quantification in Deep Neural Networks*, 2022
- **Talk at Jadavpur University (Alma Mater)**, *Simple, Fast and Practical Uncertainty Estimation in Deep Learning*, 2021: `(link here)`
- **Talk at Waymo**, *Deep Deterministic Uncertainty*, 2021
- **Spotlight Talk**, *On using Focal Loss for Neural Network Calibration*, ICML 2020 Workshop on Uncertainty and Robustness in Deep Learning (UDL): `(link here)`
- **Top Reviewer** for ICML 2020