Jishnu Mukhoti

DPhil(PhD) Candidate, Advisors: Philip Torr and Yarin Gal, University of Oxford
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Research Interests & Experience

1. Uncertainty quantification, and robustness of neural networks

3. 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

Publications

1. Jishnu Mukhoti, Yarin Gal, Philip Torr, Puneet Dokania, *Fine-tuning can cripple your foundation model; preserving features may be the solution*, (`arxiv:2308.13320`, **under submission**).

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*, 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) (**Spotlight).**

5. 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*, **ICCV 2023** Workshop on Out Of Distribution Generalization in Computer Vision (**Oral**).

6. 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).

7. 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).

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 Vocabulary Semantic Segmentation in Multi-Modal Foundation 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.

Featured Research Projects

Forgetting in Foundation Models (Ongoing)

Torr Vision Group & OATML *Oxford, UK*

- Studied how most state-of-the-art end-to-end fine-tuning methods can lead to foundation models losing their pre-trained knowledge on most real-world concepts.
- Looked into simple ways by which this "concept forgetting" can be avoided during fine-tuning.
- Paper: **Fine-tuning can cripple your foundation model; preserving features may be the solution** (`arxiv:2308.13320`), under submission.

Open-Vocabulary Semantic Segmentation

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

- Designed a compatibility function for contrastive loss to achieve patch level alignment between multi-modal encoders.
- Resulting models can zero-shot transfer to semantic segmentation in an open-vocabulary setting without requiring any task-specific annotations.
- Paper: **Open Vocabulary Semantic Segmentation with Patch Aligned Contrastive Learning** (`arxiv:2212.04994`), ***highlight and published 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 can compete with state-of-the-art uncertainty quantification methods with a deterministic single-forward pass model.
- Paper: **Deep Deterministic Uncertainty: A New Simple Baseline** (`arxiv:2102.11582`), ***highlight and published 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, spotlight in ICML 2020 UDL workshop.***
- Code: `github.com/torrvision/focal_calibration`
- Blog: `torrvision.com/focal_calibration`

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