Ankur **Sikarwar**

Research Engineer, A*STAR Singapore

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Education

June 2021 | **Birla Institute of Technology Mesra** — **Ranchi, India**
July 2017 | Bachelor of Engineering | Electronics & Communication
First Class with Distinction

Publications

R=In Review, C=Conference, P=Preprint

[C.3] **Decoding the Enigma: Benchmarking Humans and AIs on the Many Facets of Working Memory.**
Ankur Sikarwar, Mengmi Zhang
Conference on Neural Information Processing Systems. [**NeurIPS'23**]

[C.2] **Learning to Learn: How to Continuously Teach Humans and Machines.**
Parantak Singh, You Li, Ankur Sikarwar, Weixian Lei, Daniel Gao, Morgan Bruce Talbot, Ying Sun, Mike Zheng Shou, Gabriel Kreiman, Mengmi Zhang
International Conference on Computer Vision. [**ICCV'23**]

[C.1] **When Can Transformers Ground and Compose: Insights from Compositional Generalization Benchmarks.**
Ankur Sikarwar, Arkil Patel, Navin Goyal
Conference on Empirical Methods in Natural Language Processing. **[Oral]** [**EMNLP'22**]

[R.2] **Reason from Context with Self-supervised Learning.**
Xiao Liu, Ankur Sikarwar, Joo Hwee Lim, Gabriel Kreiman, Zenglin Shi, Mengmi Zhang
[In Review]

[R.1] **Human or Machine? Turing Tests for Vision and Language.**
Mengmi Zhang, Giorgia Dellaferrera, Ankur Sikarwar, Marcelo Armendariz, Noga Mudrik, Prachi Agrawal, Spandan Madan, Mranmay Shetty, Andrei Barbu, Haochen Yang, Tanishq Kumar, Shui'Er Han, Aman Raj Singh, Meghna Sadwani, Stella Dellaferrera, Michele Pizzochero, Brandon Tang, Hanspeter Pfister, Gabriel Kreiman
[In Review]

[P.1] **On the Efficacy of Co-Attention Transformer Layers in Visual Question Answering.**
Ankur Sikarwar, Gabriel Kreiman
Preprint.

Research Experience

Present / **Oct 2022** | **Agency for Science, Technology and Research | Institute for Infocomm Research** — **Singapore**
Research Engineer | Advisor: Dr. Mengmi Zhang
Developing robust memory-augmented networks for out-of-distribution generalization. Also working on self-supervised methods for learning contextual associations between objects.

Aug 2022 / **Feb 2022** | **Microsoft Research** — **Bangalore, India**
Research Intern | Advisor: Dr. Navin Goyal
Developed models capable of generalizing compositionally in grounded language understanding tasks. Also worked on the mechanistic interpretability of grounding and composition in simple multimodal Transformers.

July 2021
Research Intern | Advisor: Dr. Navin Goyal
Worked on modular neural networks and on obtaining faithful interpretations of individual reasoning modules. Also investigated compositional generalization benchmarks and exposed key design flaws in out-of-distribution testing splits.

July 2021 / **Jan 2021** | **Harvard University | Kreiman Lab** — **Cambridge, USA**
Research Assistant | Advisor: Dr. Gabriel Kreiman
Investigated the efficacy of co-attention transformer layers in multimodal tasks like Visual Question Answering. Also conducted interpretability studies on vision-language transformers using visual attention maps.

July 2019 / **May 2019** | **IIIT, Hyderabad | Center for Visual Information Technology** — **Hyderabad, India**
Research Intern | Advisor: Dr. Avinash Sharma
Worked on an end-to-end pipeline for reconstructing 3D models of humans from monocular video. Also developed toolkits for pre-processing & generating 3D mesh data of humans from a vertex-based template model.

Selected Research Projects

Self-supervised Learning for Contextual Reasoning Oct'22 - Present

Advisor: Dr. Mengmi Zhang, Prof. Gabriel Kreiman

- Working on a self-supervised learning method that captures associations between objects and their contexts.
- Proposed a new task, *Object Priming*, to evaluate contextual reasoning capabilities of models.
- Designed and conducted large-scale human psychophysics experiments to curate object priming maps from human subjects. Work under review at **AAAI 2023**.

Compositional Generalization in Grounded Language Understanding July'21 - Aug'22

Advisor: Dr. Navin Goyal

- Developed a transformer-based approach that achieves SOTA performance on grounded compositional generalization benchmarks like gSCAN and ReaSCAN.
- Investigated bottlenecks for compositional generalization in contemporary models and exposed key design flaws in previous benchmarks. Also showed that transformers generalize to higher depths of reasoning even when trained for shallower depths.
- Derived an explicit construction to mechanistically explain grounding and composition in transformers. Work accepted at **EMNLP 2022** for **Oral** presentation.

Analysis of Co-Attention in Multimodal Transformers Jan'21 - July'21

Advisor: Dr. Gabriel Kreiman

- Demonstrated that attention in co-attention transformer layers correlates more with human attention when compared with traditional CNN/LSTM networks.
- Evaluated the influence of question semantics in driving visual attention of vision-language transformers. Demonstrated that words, particularly nouns drive visual attention rather than grammar or semantics.

3D Reconstruction of Human Bodies from Monocular Video May'19 - July'19

Advisor: Dr. Avinash Sharma

- Worked on a 3D Human Mesh Reconstruction pipeline for predicting 3D mesh from a few frames of a monocular RGB video.
- Integrated OpenPose in the 3D reconstruction pipeline for prediction of joint locations of humans. Also worked on texture stitching and mapping for the reconstructed 3D models.

Talks

"Decoding the Enigma: Benchmarking Humans and AIs on the Many Facets of Working Memory"

- Libedinsky Lab, National University of Singapore — July 2023

"When Can Transformers Ground and Compose: Insights from Compositional Generalization Benchmarks"

- EMNLP 2022 — Dec 2022
- Deep NeuroCognition Lab, A*STAR Singapore — Nov 2022
- Lab Sabha, Microsoft Research India — July 2022

"On the Efficacy of Co-Attention Transformer Layers in Visual Question Answering"

- Kreiman Lab, Harvard University — June 2021

Honours and Awards

Fujitsu Laboratories Fellowship, 2023 For attending MIT-Harvard Center for Brains, Minds and Machines Summer Course.

iHack Alpha: AI-Enabled Solutions, 2021 Among Top 8 Finalists globally.

NASA International Space Apps Challenge, 2019 | Global Nominee For developing "Prophet: A distributed system for identifying and mitigating lunar dust for future moon missions."

Microsoft Codefundo++, 2019 Runner's Up, BIT Mesra.

Siemens MakeIT Real Hackathon, 2018 | Winner For developing the winning prototype "TetraChrome Lenses: Smart Glasses for Visually Impaired People" within 24 hours.

Academic Service And Leadership Roles

Organizer Journal Club, Deep NeuroCognition Lab, A*STAR Singapore

Reviewer NeurIPS'23, EMNLP'23, ACL'23, EMNLP'22

Relevant Coursework

Linear Algebra, Probability Models & Stochastic Processes, Convex Optimization, Neural Networks & Fuzzy System, Machine Learning, Convolutional Neural Networks for Visual Recognition, Natural Language Processing, Multivariable Calculus, Real Analysis, Data Structures, Information Theory & Coding

References

- Prof. Gabriel Kreiman ..... *Professor, Harvard University, MIT-Harvard Center for Brains, Minds and Machines, USA*
- Dr. Navin Goyal ..... *Principal Researcher, Microsoft Research, India*
- Dr. Mengmi Zhang ..... *Principal Investigator and Senior Scientist, CFAR and I2R, A*STAR, Singapore*