Subhajit Chaudhury

CONTACT INFORMATION

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RESEARCH INTEREST

My research interest lies at the intersection of Computer Vision and Reinforcement Learning. In my Ph.D. thesis, my goal is to propose learning methods in deep neural networks that are robust against adversarial attacks. At IBM Research, I work on multi-modal machine learning trying to learn common concepts between images and natural language captions, and reinforcement learning.

EDUCATION

The University of Tokyo, Japan April 2018 - March 2021
Ph.D., EECS, Graduate School of Information Science and Technology
Advised by Prof. Toshihiko Yamasaki

Indian Institute of Technology (IIT), Bombay, India July 2012 - June 2014
M.Tech, Department of Electrical Engineering
GPA: **9.81 out of 10**
Topic: Efficient deformable 3D graphics rendering for real-time Haptics applications.

Jadavpur University, India July 2008 - June 2012
B.E.(Hons.) Department of Electrical Engineering
GPA: **8.90 out of 10** (**Rank: 3rd/125**)
Topic: Vision-based indoor structure discovery for locomotion in autonomous robots.

WORK EXPERIENCE

Research Scientist, IBM Research AI, Tokyo April 2017- Present
Topics: Weakly Supervised Event Detection in Sports Videos, Adversarial Imitation Learning from Video Demonstrations, Reinforcement learning in Dialog-based Systems.

Researcher, NEC Research Labs, Tokyo Oct 2014- March 2017
Topic: Deep learning-based infrastructure surveillance using Computer Vision methods. Delivered a vision-based crack detection system used that was deployed in real-life applications.

Teaching Assistant, IIT Bombay July 2012 - June 2014
Responsibilities: Held recitations, organized exams and evaluated papers for the courses on Signals and System, Digital Signal Processing and Computer Vision.

SELECTED PUBLICATIONS

1) *Subhajit Chaudhury* and Toshihiko Yamasaki, **Investigating Generalization in Neural Networks under Optimally Evolved Training Perturbations**, IEEE **ICASSP**, 2020.

2) Sourav Mishra, *Subhajit Chaudhury*, Hideaki Imaizumi and Toshihiko Yamasaki **Assessing Robustness of Deep learning Methods in Dermatological Workflow**, ACM Conference on Health Inference and Learning (**CHIL**), 2020 [**Spotlight paper**].

3) Daiki Kimura, *Subhajit Chaudhury*, Minori Narita, Asim Munawar, and Ryuki Tachibana, **Adversarial Discriminative Attention for Robust Anomaly Detection**, IEEE **WACV**, 2020.

4) *Subhajit Chaudhury*, Daiki Kimura, Phongtharin Vinayavekhin, Asim Munawar, Ryuki Tachibana, Koji Ito, Yuki Inaba, Minoru Matsumoto, Shuji Kidokoro, and Hiroki Ozaki, **Unsupervised Temporal Feature Aggregation for Event Detection in Unstructured Sports Videos**, IEEE **ISM**, Dec 2019. (**Long paper**)

5) *Subhajit Chaudhury*, Daiki Kimura, Asim Munawar, and Ryuki Tachibana **Injective State-**

Image Mapping facilitates Visual Adversarial Imitation Learning , IEEE International Workshop on Multimedia Signal Processing (**MMSP**), 2019. (Oral)

6) Hiya Roy, *Subhajit Chaudhury*, Toshihiko Yamasaki, Danielle DeLatte, Makiko Ohtake, Tatsuaki Hashimoto, **Lunar surface image restoration using U-net based deep neural networks, Lunar and Planetary Science Conference (LPSC), 2019**

7) Daiki Kimura, *Subhajit Chaudhury*, Ryuki Tachibana and Sakyasingha Dasgupta, **Internal Model from Observations for Reward Shaping**, **ICML** workshop on Adaptive and Learning Agents (ALA) 2018 and **AAAI** Workshop on Reinforcement Learning in Games, 2019.

8) Phongtharin Vinayavekhin, *Subhajit Chaudhury*, Asim Munawar, Don Joven Agravante, Giovanni De Magistris, Daiki Kimura and Ryuki Tachibana, **Focusing on What is Relevant: Time-Series Learning and Understanding using Attention**, International Conference on Pattern Recognition (**ICPR**), 2018.

9) Tadanobu Inoue, *Subhajit Chaudhury*, Giovanni De Magistris and Sakyasingha Dasgupta, **Transfer learning from synthetic to real images using variational auto-encoders for robotic applications**, IEEE **ICIP**, 2018.

10) *Subhajit Chaudhury*, Sakyasingha Dasgupta, Asim Munawar, Md. S. Khan and Ryuki Tachibana, **Conditional generation of multi-modal data using constrained embedding space mapping**, **ICML**, Implicit Models Workshop, 2017

11) *Subhajit Chaudhury*, Sakyasingha Dasgupta, Asim Munawar, Md. Salam Khan, Ryuki Tachibana, **Text to image generative model using constrained embedding space mapping**, IEEE International Workshop on Machine Learning for Signal Processing (**MLSP**), 2017 (**Oral**)

12) *Subhajit Chaudhury*, Gaku Nakano, Jun Takada, Akihiko Iketani, **Spatial-temporal motion field analysis for crack detection on concrete surfaces**, IEEE **WACV** 2017

13) *Subhajit Chaudhury*, Hiya Roy, **Can fully convolutional networks perform well for general image restoration problems?**, International Conference on Machine Vision Applications (**MVA**), 2017

14) Sourav Saha, Pritha Ganguly, *Subhajit Chaudhury*. **Vision based human pose estimation for virtual cloth fitting**. Proceedings of the 2014 Indian Conference on Computer Vision Graphics and Image Processing (**ICVGIP**)

15) *Subhajit Chaudhury*, Subhasis Chaudhuri, **Volume preserving haptic pottery**, 2014 IEEE Haptics Symposium (**HAPTICS**), Houston, TX, 2014, pp.129-134. (**Oral**)

Skills

- **Programming Languages**: *Python, C++, Java*
- **Machine learning Tools**: *Pytorch, Tensorflow, Keras, scikit-learn*
- **Tools**: *Matlab, ROS, Gazebo, OpenCV, CUDA, OpenGL*

Selected Research Projects

- **Weakly Supervised Event Detection for Sports Videos:** Developed a **weakly supervised event detection** method for sports video analysis without player annotations. Our feature aggregation method improved player retrieval by 8% AP and event detection by 13% F1 score.

- **Adversarial Imitation Learning from YouTube Videos:** Developed **imitation learning** methods to learn **action policies** from raw videos demonstrations using Generative Adversarial Networks. Our method enabled learning expert policies from raw single **YouTube** videos.

- **Transfer learning from synthetic to real images using VAEs for robotic applications:** Developed a method to transfer object detection learned in a simulation environment to the real world by performing a two-stage training on variational auto-encoders (VAE). The proposed method is 6 to 7 times more precise than baseline methods and robust to lighting conditions.

- **Spatial-temporal motion analysis for invisible crack detection:** Developed a **crack detection algorithm** that identifies internal cracks by finding discontinues in dense 2D motion fields using energy minimization on a **Conditional Random Fields** (CRF). Improved F1 score by 0.22 compared to state-of-the-art image based methods.

- **Deep learning for image-based crack detection** : Lead developer of a **fully convolutional network** based system for pixel-level crack localization from raw images. Collaborated with **Texas Department of Transportation (TxDOT)** for application on real captured road videos with **real-time performance (16fps for VGA images)** with similar localization accuracy to state-of-the-art methods.
  Press Release: https://www.nikkei.com/article/DGXMZO57409840Q0A330C2LKA000

Academic research projects

- **Volume preserving haptic pottery:** Developed a realistic deformation model for interactive rendering of semi-solid clay-based virtual pottery with volume preservation. The proposed model enabled real-time visual feedback at 25 fps and tactile feedback at 1000 Hz which is much faster than prior works.

- **Feel Chat : 3D interactive virtual chat room with tactile feedback** : Developed a virtual reality chatting system using virtual reality headsets and wearable tactile suit where users can touch the surrounding virtual environment by tactile feedback.

- **Web-cam based virtual trial room:** Developed a real-time virtual cloth fitting using generic web camera input by structurally aligning the input garment to the skeletal joints using OpenCV.

Awards and Achievements

- Received **Student Travel Grant** to present Ph.D. thesis at **AAAI Doctoral Consortium** in New York, USA.
- **Best student paper, honorable mention** (out of 321 papers) at **MIRU 2019**, a top domestic Computer Vision conference in Japan.
- Obtained **Best Paper Award** (1st in 126 accepted papers) and **Best Presentation Award** at Symposium on Sensing via Image Information (SSII), 2019.
- Secured All India Rank **33 out of 110,125** students in Electrical Engineering, GATE-2012.
- Secured rank **86/80,000** in West Bengal Joint Entrance Examination, 2008 for Engineering.

Professional Activities

- Reviewer for ICRA2018, IROS2018, IEEE Transactions on Multimedia (TMM), 2018, IJCAI 2019, ECML-PKDD 2019, ICRA2020.
- Program Commitee member for IJCAI2020.

Extra curricular activities

- Executive Council member of IIT Bombay Alumni Association in Tokyo from 2015.
- Passed Japanese Language Proficiency Test, N4 level. (Ability have general conversations)
- IIT Bombay swimming club member and participated in various swimming competitions.