Subhajit Chaudhury

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RESEARCH INTEREST

My interests lie in the intersection of computer vision and reinforcement learning. Currently, at IBM Research-Tokyo, I am working on improving the sample efficiency of reinforcement learning(RL) algorithms using model based approaches. Additionally, I also work on multi-modal generative models for cross-domain data generation like generating images from raw text or speech.

EDUCATION

Indian Institute of Technology, Bombay, India   July 2012 - June 2014
M.Tech, Department of Electrical Engineering
GPA : **9.81 out of 10**
Advised by Prof. Subhasis Chaudhuri

Jadavpur University, India   July 2008 - June 2012
B.E.(Hons.) Department of Electrical Engineering
GPA - **8.90 out of 10** (**Rank: 3rd/125**)
Advised by Prof. Amitava Chatterjee

PUBLICATIONS

1) Tadanobu Inoue, *Subhajit Chaudhury*, Giovanni De Magistris and Sakyasingha Dasgupta, **Transfer learning from synthetic to real images using variational auto-encoders for robotic applications**, arXiv:1709.06762 (submitted to ICRA 2018)

2) *Subhajit Chaudhury*, Sakyasingha Dasgupta, Asim Munawar, Md. Salam Khan and Ryuki Tachibana, **Conditional generation of multi-modal data using constrained embedding space mapping**, International Conference on Machine Learning (ICML), Implicit Models Workshop, 2017

3) *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**)

4) *Subhajit Chaudhury*, Gaku Nakano, Jun Takada, Akihiko Iketani, **Spatial-temporal motion field analysis for crack detection on concrete surfaces**, IEEE Winter Conference on Applications of Computer Vision (WACV) 2017

5) *Subhajit Chaudhury* and Hiya Roy, **Can fully convolutional networks perform well for general image restoration problems?**, Intl. Conf. on Machine Vision Applications, 2017

6) Vijay Daultani, *Subhajit Chaudhury*, Kazuhisa Ishizaka, **Convolutional Neural Network Layer Re-ordering for acceleration**, 20th Workshop on Synthesis And System Integration of Mixed Information (SASIMI), Kyoto, Japan, 2016

7) 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)

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

RESEARCH EXPERIENCE	**IBM Research AI, Tokyo, Japan**	April 2017- Present

Topic : *Deep reinforcement learning for application independent decision making platform*
Position : ***Staff Researcher***, *Cognitive Robot Innovation Laboratories*

- **Model-based imitation learning from state trajectories** : Developed an imitation learning method that learns action policies from expert trajectories consisting of observations only. A dynamics model, learned from model-free trajectories, is used to recover the policy gradients for model-based policy update. Our method is shown to be sample efficient compared to model-free reinforcement learning techniques while also having the added benefit of quick transfer learning.

- **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 precisely than baseline methods and robust to lighting conditions.

- **Conditional generation of multi-modal data using constrained embedding space mapping** : Developed a multi-modal generative method that maps multiple data modalities to a common latent space enabling simple cross modal inference. Proposed method can synthesize images from text and raw audio input while producing better PSNR values than baseline methods.

NEC Central Research Labs, Japan   Oct 2014- March 2017
Topic : *Deep learning based predictive infrastructure maintenance*
Position : ***Researcher***, *Predictive Infrastructure Maintenance group*

- **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** : Developed 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.

- **Accelerating convolutional neural nets by layer re-ordering** : Obtained computational speed-up of 4x in activation units with 5% overall improvement, in convolutional neural networks inference by rearranging pooling and activation layer ordering.

ACADEMIC RESEARCH PROJECTS	**Indian Institute of Technology (IIT), Bombay**	July 2012- June 2014

Master of Technology (M. Tech) thesis, India   Prof. Subhasis Chaudhuri

- **Volume preserving haptic pottery** : Developed a realistic deformation model for interactive rendering of semi-solid clay based virtual pottery with volume preservation. 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 touch** : 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.

Jadavpur University, India   July 2008 - June 2012
Undergraduate (B.E.) project   Prof. Amitava Chatterjee

- **Vision based door detection** : Developed a door detection algorithm for mobile robot navigation by generating proposals for candidate door-like structures based on geometric features.

PATENTS

1) Subhajit Chaudhury and Gaku Nakano , **A device for automatic crack detection from 2D motion in video sequences**, PCT/JP2016/072700 (*filed at NEC*)

2) Subhajit Chaudhury and Gaku Nakano , **A device for direct 3D deformation estimation from 2D optical flow**, PCT/JP2016/001406 (*filed at NEC*)

3) Subhajit Chaudhury, Vineet Gokhale, Subhasis Chaudhuri , **A virtual reality system and method for providing synchronous tactile feedback for user interaction**, Indian Patent, 503/MUM/2015 (*filed at IIT Bombay*)

AWARDS AND ACHIEVEMENTS

- Secured All India Rank **33 out of 110,125** students in Electrical Engineering, GATE-2012.
- Secured All India Rank **125 out of 72,680** students in Electrical Engineering, GATE-2011.
- Secured rank **86/80,000** in West Bengal Joint Entrance Examination, 2008 for Engineering.
- Received academic excellence award for **1st** position in high school for both class 10 (ICSE-2006) and class 12 (ISC-2008) national board exam.
- Awarded **1st** position prize for winning Don-Bosco Inter-School coding competition.
- Achieved **2nd** position in All-Bengal spelling competition.

TEACHING EXPERIENCE

- **EE702: Computer Vision**   Spring 2014
  Teaching Assistant for *Prof. Subhasis Chaudhuri*, IIT Bombay

- **EE603: DSP and its application**   Autumn-2013
  Teaching Assistant for *Prof. Animesh Kumar*, IIT Bombay

- **EE210: Signals and System**   Spring-2013
  Teaching Assistant for *Prof. Animesh Kumar*, IIT Bombay

RELEVANT COURSES

Electrical Engineering: Wavelets, Statistic Signal Processing , Applied Linear Algebra , Digital Signal Processing, Number Theory and Cryptography, Digital Message Transmission

Computer Science: Computer Vision, Foundations of Machine Learning, Computer Graphics, Advanced Computer Graphics

COMPUTER SKILLS

- **Programming Languages** : *C, C++, Java, Python*
- **Tools** : *Matlab, OpenCV, CUDA, OpenGL*
- **Machine learning Tools** : *scikit-learn, Theano + Lasagne, Keras, Caffe, Matconvnet*

EXTRA CURRICULAR ACTIVITIES

- Executive Council member of IIT Bombay Alumni Association in Tokyo from 2015.
- Passed Japanese Language Proficiency Test, N4 level.(Ability to follow general conversations)
- Involved in Japanese to English document translation website creation for new coming foreign students to Japan
- Prior member of IIT Bombay swimming club and participated in various swimming competitions.