Ramprasaath Ramasamy Selvaraju
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Virginia Tech

RESEARCH INTERESTS

Developing and Visualizing Deep Learning models for Computer Vision and Natural Language

EDUCATION

Virginia Tech (PhD), 2015 - Present
- Computer Engineering, Studying Machine Learning and Computer Vision
- GPA – 4.0

BITS-Pilani Hyderabad (Bachelors and Masters)
- Bachelor of Engineering (Honor) in Electrical and Electronics
- Master of Science (Honor) in Physics

WORK EXPERIENCE

Teaching Assistant
- Data Structures and Algorithms (2 semesters)

RESEARCH EXPERIENCE

Virginia Tech
- Undergraduate Thesis (Jan – July 2015)

Oxford University
- Undergraduate Thesis (May – December 2014)

Brown University
- Undergraduate Summer Internship (May – August 2013)

COURSE WORK

Computer Vision (Intro and Advanced), Deep Learning for Perception, Optimization in High-dimensional Spaces, Machine Learning and Bayesian Statistics (Ongoing)

COMPUTER SKILLS

Programming Languages: C, C++, Python, LuaJIT
Deep Learining Libraries/frameworks: Caffe, Torch, Tensorflow (learning)
Application Software: Matlab, Visual Studio, Eclipse
Operating Systems: Linux (Ubuntu), Windows and Android

CURRENT RESEARCH PROJECTS

Generating/Modifying images for Visual Question Answering (VQA)
(With the guidance of Dhruv Batra and Devi Parikh)
- Evaluate if current vision models truly understand the image and language (question and answer) by making them generate or modify images.
- Task 1 (QA->V): Given a Question (Q) and an Answer (A), the model has to generate an visual (V) image
- Task 2 (VQA-> V'QA'): Given an visual (V) image, Question (Q) and Answer (A), the model has to modify the image semantically so the answer (A) changes (to A')
- This can serve as a new form of Visual Turing Test

Grad-CAM: Gradient-weighted Class Activation Mapping
(with the guidance of Dhruv Batra and Devi Parikh)
- Gradient-based visualization technique that:
  - can make any CNN-based model interpretable
  - is class discriminative
  - requires no architectural change -> no need for re-training
  - does not compromise on accuracy

- Our visualization approach provides tools for:
  - understanding networks (eg. debugging)
  - increasing user confidence
  - localization
- Generalizes CAM (Zhou et al, CVPR'16) to any type of CNNs
- Visualize models for a variety of applications: Image Classification, Image Captioning and Visual Question Answering
- **Code: https://github.com/ramprs/grad-cam**
- Arxiv paper: Coming out very soon

PAST PROJECTS

Diverse Beam Search
(With the guidance of Dr Dhruv Batra)
- The goal is to get diversity in M-best outputs from Recurrent Neural Network (RNN) models
- Arxiv paper: Coming soon

Counting Everyday objects in Everyday Scenes
(With the guidance of Dr Devi Parikh and Dr Dhruv Batra)
- The goal of this project is to count the number of occurrences of Common Everyday occurring categories in real-world scenes
- I was responsible for running counting experiments on Visual Question Answering (VQA) dataset, and on Images generated by the Deep Dream algorithm
- Arxiv paper: https://arxiv.org/abs/1604.03505

Semantic Paintbrush
(With the guidance of Dr Philip Torr, University of Oxford)
- Developed an interactive augmented reality system where a carer helps the user understand the scene better through interactive labeling with laser pointer through a shared virtual environment.
- I was responsible for Accurate Multi camera calibration, laser tracker, Interactive correction of disparity, and labeling.

BlindFind
(With the guidance of Dr Benjamin Kimia, Brown University)
- Worked on designing a vision based navigation system to help the blind/vision impaired people navigate indoor environments, through use of glass mounted stereo/depth haptic belt mounted IMUs

Sparse 3D surface reconstruction from Multiple Images
(With the guidance of Dr KMM Rao, BITS-Pilani/ISRO)
- Worked on reconstructing scenes from multiple un-calibrated images through feature matching, epipolar geometry estimation, and triangulation to estimate world coordinates by minimizing the reprojection error.

PUBLICATIONS

Making Deep Models Interpretable Without Making Interpretable Deep Models: Gradient-Based Discriminative Localization & Visualization
Ramprasaath Selvaraju, Abhishek Das, Ramakrishna Vedantam, Michael Cogswell, Devi Parikh, Dhruv Batra
(Under review)

Diverse Beam Search: Diverse Decoding from Neural Sequence Models
(Ashwin Kalyan, Michael Cogswell, **Ramprasaath Selvaraju**, Qing Sun, Stefan Lee, David Crandall, Dhruv Batra)
Counting Everyday Objects in Everyday Scenes
Prithvijit Chattopadhyay, Ramakrishna Vedantam, **Ramprasaath Selvaraju**, Dhruv Batra and Devi Parikh
(https://arxiv.org/abs/1604.03505)

The Semantic Paintbrush: Interactive 3D Mapping and Recognition in Large outdoor Spaces
Ondrej Miksik, Vibhav Vineet, Morten Lidegaard, **Ramprasaath Selvaraju**, Matthias Niessner, Stuart Golodetz, Stephen Hicks, Patrick Perez, Shahram Izhadi, Philip HS Torr (Oral at Computer Human Interaction Conference, CHI 2015)

Automated Calorimetric Analysis in Paper based Sensors
Sanyam Garg, **Ramprasaath Selvaraju**, Kunda MM Rao and Suman Kapur (Presented at International Conference in Image Processing ICIP 2014)

A novel algorithm for Image fusion and enhancement using Dual Tree Complex Wavelet Transform
Ramprasaath RS, KMM Rao (Presented at 29th National Convention of Electronics and Telecommunication Engineering, 2013)

HONORS

Reviewer for Neural Information Processing Systems **(NIPS'16)**
Reviewer for Computer Vision and Pattern Recognition (CVPR'16)

EXTRA-CURRICULAR ACTIVITIES

Won the Virginia Division Table-Tennis Championship
Placed Second at US Mid-Atlantic Region Table Tennis Championship and represented Virginia Tech at the Nationals

REFERENCES

Dr. Devi Parikh, Assistant Professor, Virginia Tech - parikh@vt.edu
Dr. Dhruv Batra, Assistant Professor, Virginia Tech – dbatra@vt.edu
Dr. Philip Torr, Professor, University of Oxford – philip.torr@eng.ox.ac.uk
Dr. Benjamin Kimia, Professor, Brown University – kimia@brown.edu
Dr. KMM Rao, Deputy Director (rtd), ISRO – kmm@drkmm.com