Ramprasaath (Ram) RS

Interpretability · Computer Vision · Deep Learning

Ph.D Student, Georgia Tech

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Research Interests

Developing algorithms for making AI Transparent, Interpretable, and unbiased.

Education

Georgia Tech — *Atlanta, GA, USA*

Ph.D in Computer Science — *Aug. 2017 - Present*

- Advised by Dr. Devi Parikh and working closely with Dr. Dhruv Batra.

Virginia Tech — *Blacksburg, VA, USA*

Ph.D in Computer Engineering — *Aug. 2015 - July. 2017*

- Advised by Dr. Devi Parikh and working closely with Dr. Dhruv Batra.

Birla Institute of Technology & Science (BITS)-Pilani — *Hyderabad, India*

Bachelor of Engineering (Honor) in Electrical and Electronics

Master of Science (Honor) in Physics — *Aug. 2010 - May. 2015*

Publications

1. **Ramprasaath R. Selvaraju***, Prithvijit Chattopadhyay*, Mohamed Elhoseini, Tilak Sharma, Dhruv Batra, Devi Parikh, and Stefan Lee. **"Choose Your Neuron: Incorporating Domain Knowledge into Deep Networks via Neuron Importance"** (Under review at CVPR 2018)
2. **Ramprasaath R. Selvaraju**, Michael Cogswell, Abhishek Das, Ramakrishna Vedantam, Devi Parikh, and Dhruv Batra. **"Grad-CAM: Visual Explanations from Deep Networks via Gradient-based Localization."** In Proceedings of International Conference on Computer Vision, 2017. arXiv:1610.02391 (2016).
3. Vijayakumar Ashwin K., Michael Cogswell, **Ramprasaath R. Selvaraju**, Qing Sun, Stefan Lee, David Crandall, and Dhruv Batra. **"Diverse Beam Search: Decoding Diverse Solutions from Neural Sequence Models."** arXiv:1610.02424 (2016). (To appear at AAAI, 2017)
4. Prithvijit Chattopadhyay*, Ramakrishna Vedantam*, **Ramprasaath R. Selvaraju**, Dhruv Batra, and Devi Parikh. **"Counting Everyday Objects in Everyday Scenes."** In Proceedings of Computer Vision and Pattern Recognition, 2017. arXiv:1604.03505 (2016).
5. Miksik Ondrej, Vibhav Vineet, Morten Lidegaard, **Ramprasaath R. Selvaraju**, Matthias Nießner, Stuart Golodetz, Stephen L. Hicks, Patrick Pérez, Shahram Izadi, and Philip HS Torr. **"The semantic paintbrush: Interactive 3d mapping and recognition in large outdoor spaces."** In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, pp. 3317-3326. ACM, 2015.
6. Garg Sanyam, **Ramprasaath R. Selvaraju**, Suman Kapur, and Kunda MM Rao. **"Automated colorimetric analysis in paper based sensors."** In 2014 IEEE International Conference on Image Processing (ICIP), pp. 3607-3611. IEEE, 2014.
7. **Ramprasaath R. Selvaraju**, Spandana P, and Kunda MM Rao. **"A novel algorithm for Image fusion and enhancement using Dual Tree Complex Wavelet Transform."** In 29th National Convention on Electronics and Telecommunication Engineers at Institute of Engineers, Hyderabad, 2013.

Industry Experience

Research Intern — *CA, USA*

Facebook Inc. — *Jan 2017 - May. 2017*

Developing framework for interpreting and visualizing Facebook's deep models.

Teaching Experience

Teaching Assistant — *Virginia Tech*

Data Structures and Algorighms — *Aug. 2015 - May. 2016*

Academic Internships

Virginia Tech — *VA, USA*

Master's Thesis working with **Devi Parikh** — *Jan. 2015 - Aug. 2015*

- Worked on building curious systems that ask Natural Language open-ended questions about an image.

Oxford University *Oxford, UK*

Bachelor's Thesis working with **Philip Torr** and **Stephen Hicks** *May. 2014 - Dec. 2014*

- Worked on developing 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. Published as Oral talk at CHI'15.

Brown University *RI, USA*

Summer Internship working with **Benjamin Kimia** *May. 2013 - Aug. 2013*

- 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.

Course Work

- Mathematical Foundations for ML
- Computer Vision (Intro and Adv.)
- Adv. Machine Learning
- Deep Learning for Perception
- Optimization in High-dim Spaces
- Bayesian Statistics

Skills

Programming	Python, Lua, MATLAB, C/C++
Deep Learning Frameworks	Tensorflow, Caffe, Torch
Operating Systems	Linux (Ubuntu), MacOS, Windows and Android

Projects

Making deep networks unbiased through interpretability *Georgia Tech*

With the guidance of Devi Parikh *2017*

- The goal of this project is to explore approaches that help humans understand when and how a deep model is biased, and give them the power to correct them through NIWT (Neuron-Importance aware Weight-Transfer).

Choose your Neuron: Incorporating Domain Knowledge into Deep Networks via Neuron Importance *Georgia Tech*

With the guidance of Stefan Lee, Devi Parikh and Dhruv Batra *2017*

- In this work we introduce a simple, highly efficient zero-shot learning approach based on the observation that individual neurons in deeper layers of a CNN learn semantic concepts, and that Grad-CAM weights provide a notion of the importance of a neuron for any target class.
- Our approach NIWT (Neuron Importance-Aware Weight Transfer) learns to map domain knowledge about novel classed onto the dictionary of semantic concepts and then solves of the network parameters which can effectively combile these concepts.
- In addition to achieving state-of-the-art results we show how grounding interpretable natural language in the concepts learned by neurons us name neurons in the deep network, thereby providing both textual and visual explanations for model decisions.
- Arxiv Paper: (To be out shortly)

Grad-CAM: Visual Explanations from Deep Networks via Gradient-based Localization *Virginia Tech*

With the guidance of Dhruv Batra and Devi Parikh *2016*

- Developed a Deep Neural Network Visualization technique called, Grad-CAM (Gradient-weighted Class Activation Mapping) that:
  - is class-discriminative and can make any CNN-based model interpretable
  - requires no change in architecture $\rightarrow$ no need for retraining $\rightarrow$ no compromize on accuracy
- Grad-CAM provides tools for:
  - understanding networks (eg. debugging), uncover bias and instill trust in user
- Can visualize models for a variety of applications: Image Classification, Image Captioning and Visual Question Answering
- Code: `https://github.com/ramprs/grad-cam`
- Arxiv Paper: `https://arxiv.org/abs/1610.02391`
- Demo: `http://gradcam.cloudcv.org`

Diverse Beam Search: Decoding Diverse Solutions from Neural Sequence Models *Virginia Tech*

With the guidance of Dhruv Batra *2016*

sequences that differ only slightly from each other.

Lack of diversity in the decoded solutions is fundamentally crippling in AI problems with significant ambiguity.

- To overcome this problem, we propose Diverse Beam Search (DBS), an alternative to BS that decodes a list of diverse outputs by optimizing for a diversity-augmented objective.
- Code: `https://github.com/ashwinkalyan/dbs`
- Arxiv Paper: `https://arxiv.org/abs/1610.02424`
- Demo: `dbs.cloudcv.org`

Counting Everyday Objects in Everyday Scenes *Virginia Tech*

With the guidance of Devi Parikh and Dhruv Batra *2015*

- The goal of this project is to count the number of occurrences of Common Everyday occurring categories in real-world scenes
- Arxiv paper: `https://arxiv.org/abs/1604.03505`

Extra-curricular Achievements

2016	**First Place**, Virginia Division Table-Tennis Championship	*VA, USA*
2016	**Second Place**, US Mid-Atlantic Region Table-Tennis Championship	*NC, USA*
2016	**Represented Virginia Tech**, US-Canada National Table-Tennis Championship	*TX, USA*

References

- Dr. Devi Parikh, Assistant Professor, Georgia Tech - parikh@gatech.edu
- Dr. Dhruv Batra, Assistant Professor, Georgia Tech - dbatra@gatech.edu
- Dr. Stefan Lee, Research Scientist, Georgia Tech - steflee@gatech.edu
- Mr. Tilak Sharma, Manager, Applied Machine Learning, Facebook Inc - tilaksharma@fb.com