Ramprasaath (Ram) RS

Interpretability · Computer Vision · Deep Learning

Ph.D Student, Georgia Tech

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Research Interests

Developing Transparent, Interpretable and Explainable AI models that reveal why they believe what they believe.

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**, 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).
2. 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). (Under review at AAAI, 2017)
3. Chattopadhyay Prithvijit, 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).
4. 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.
5. 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.
6. **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.

Work 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*

Research Experience

Virginia Tech *VA, USA*

Undergrad Thesis working with **Devi Parikh** *Jan. 2015 - Aug. 2015*

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

University of Oxford *Oxford, UK*

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

Projects

Interpretable Zero-Shot Learning *Georgia Tech*

With the guidance of Devi Parikh and Dhruv Batra *2017*

- The goal of this project is to explore approaches that allow humans to directly impart domain knowledge into deep networks.
- This can help us with:
  - Learning reliable abstractions better and faster with very few training data.
  - Building models that are unbiased.

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 → no need for retraining → 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*

- Traditional Beam Search explores the search space in a greedy left-right fashion – resulting in 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.
- In addition to generating diverse predictions, it also helps finding better top-1 solutions.
- 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`

Reviewing

- Reviewer for Neural Information Processing Systems
- Reviewer for Computer Vision and Pattern Recognition
- Reviewer for International Conference on Computer Vision

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
- Mr. Tilak Sharma, Manager, Facebook Inc - tilaksharma@fb.com