
Diving Deeper into Deep Learning

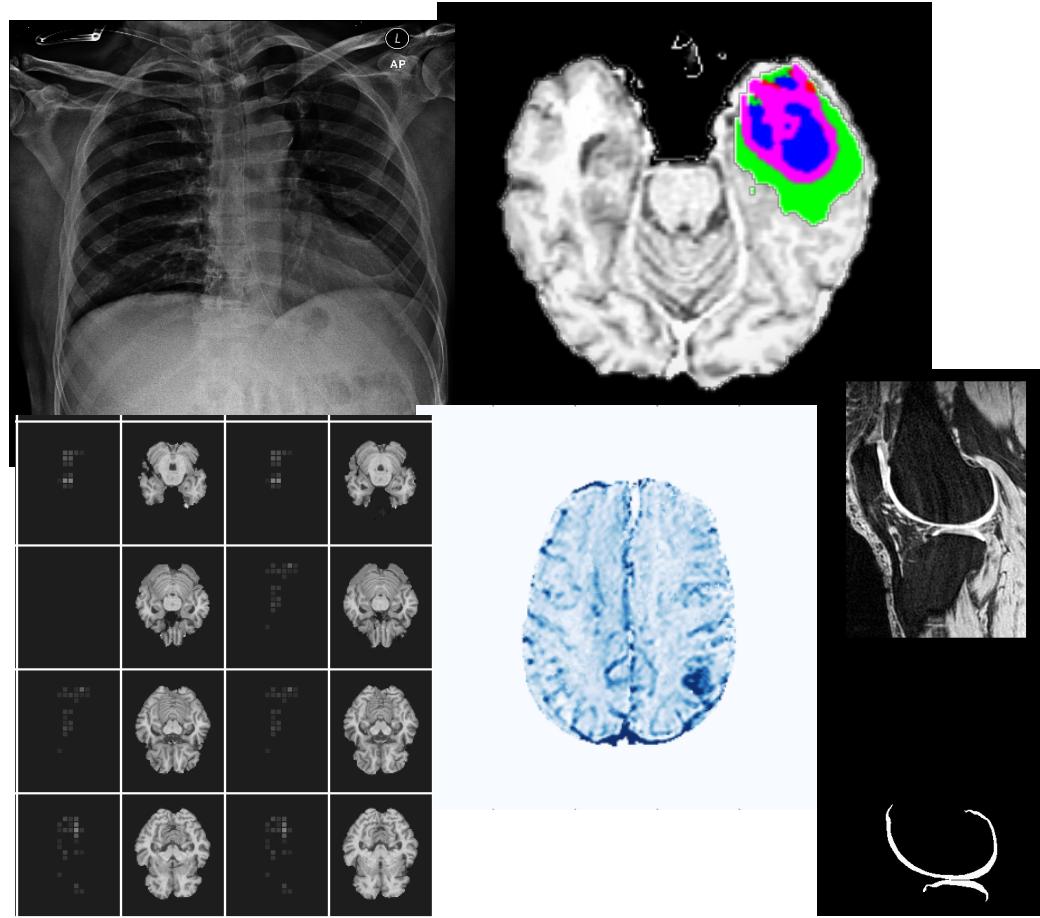
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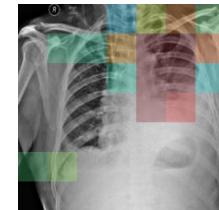
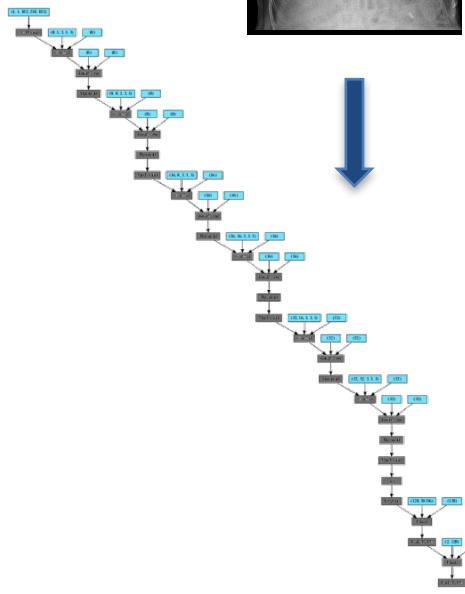
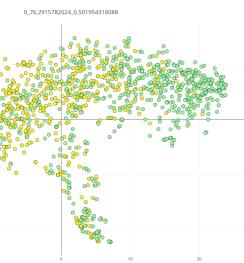
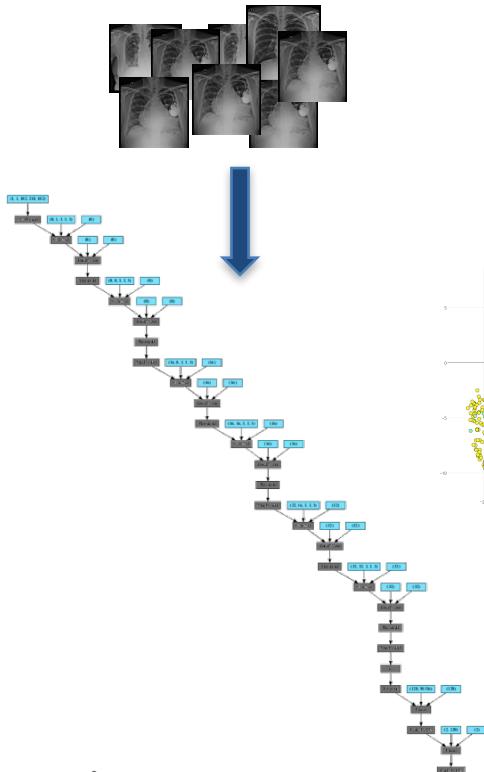


Problems

1. Chest X-Rays Diagnosis
2. CT Head diagnosis
3. Brain Tumor Segmentation
4. Grading of Brain Tumors using Perfusion
5. Alzheimer's diagnosis
6. Knee Cartilage segmentation
7. Interstitial Lung Disease Quantification
8. ...

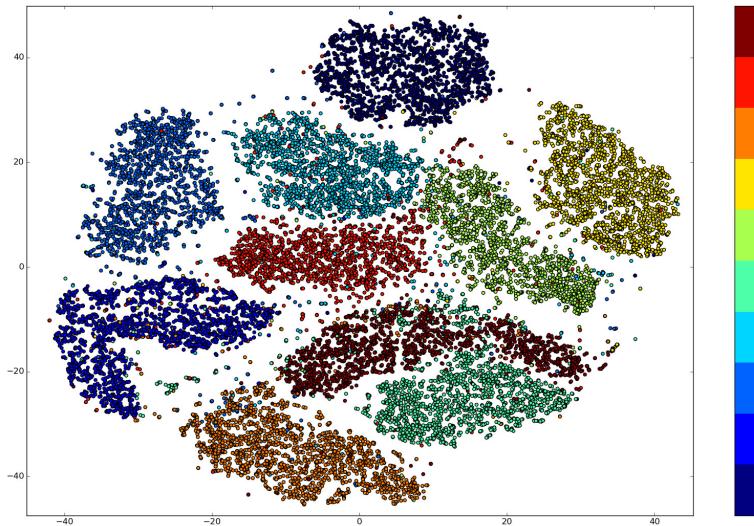


Decoding Deep Learning



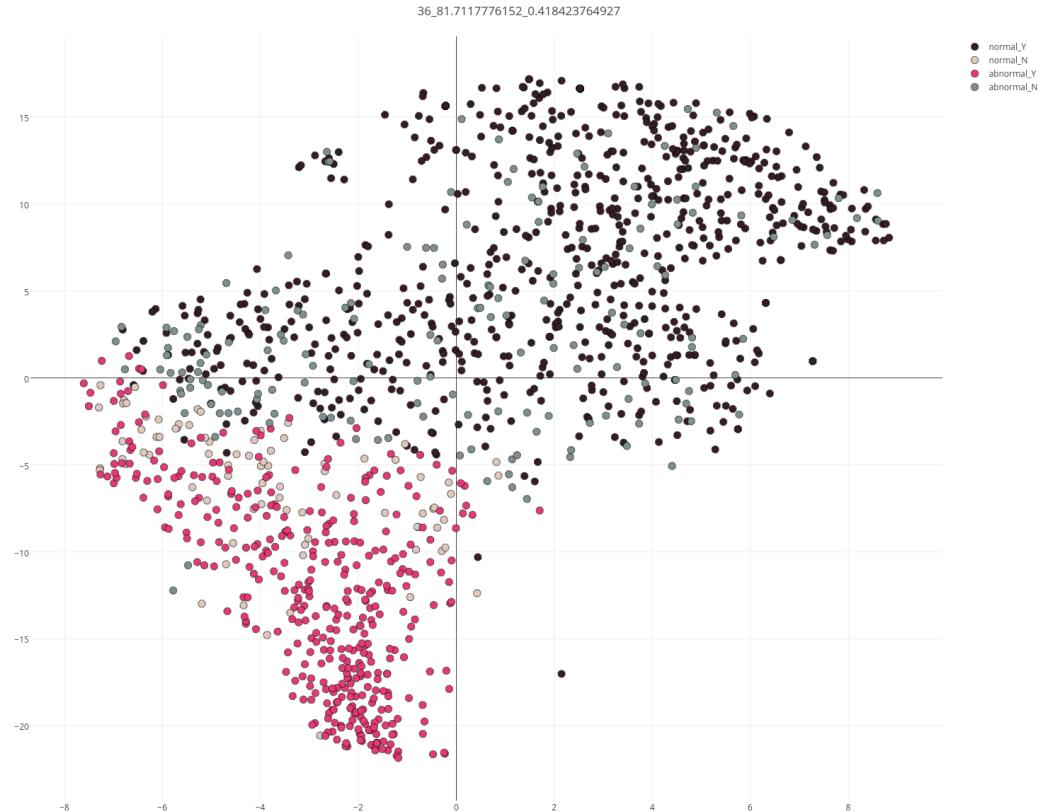
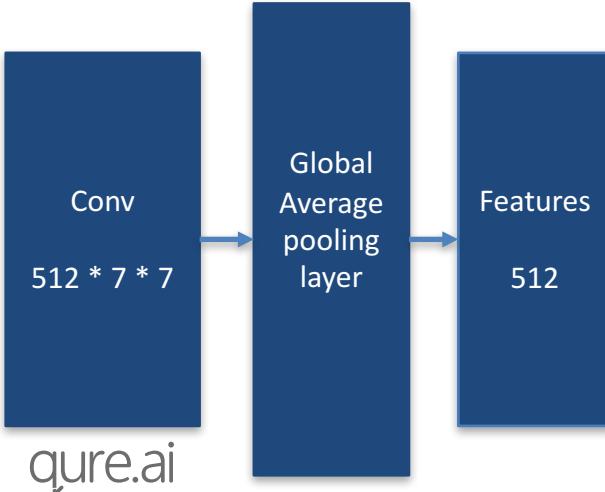
t-SNE

- t-Distributed Stochastic Neighbor Embedding (van Der Mateen and Hinton, 2008)
- Visualizing n-dimensional data in lower dimensions
- Able to capture local structure of high dimensional data as well as global structure such as clusters



t-SNE on Chest X-Rays

1. Resnet 18 trained on Chest X-Rays to classify into normal and abnormal
2. T-SNE of the outputs of the Global Average Pooling layer on 1300+ validation data points



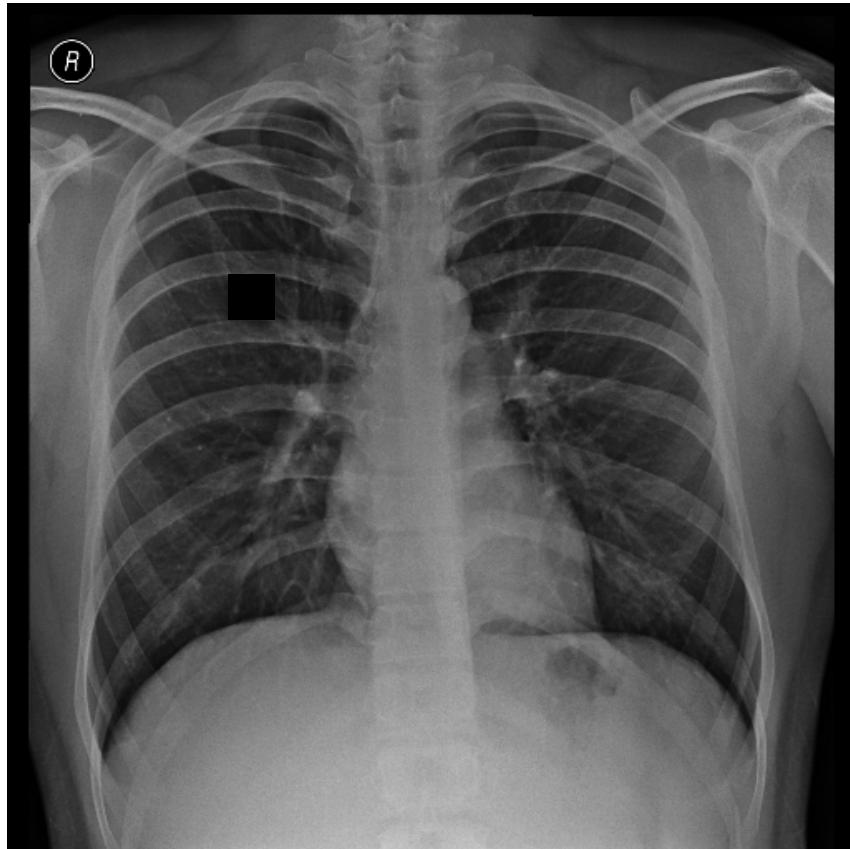
Heatmaps

Perturbation Analysis

- Change in classification values due to perturbation in inputs
- Measure effect of infinitesimal perturbation in each pixel value to create saliency maps (Simonyan et al., 2013)

$$\text{change} = \left| \frac{\partial S^c}{\partial x_{ij}} \right|$$

- Occlude patches of images by zero patch or average of pixel values and measure change in classification score. Not suitable for medical imaging



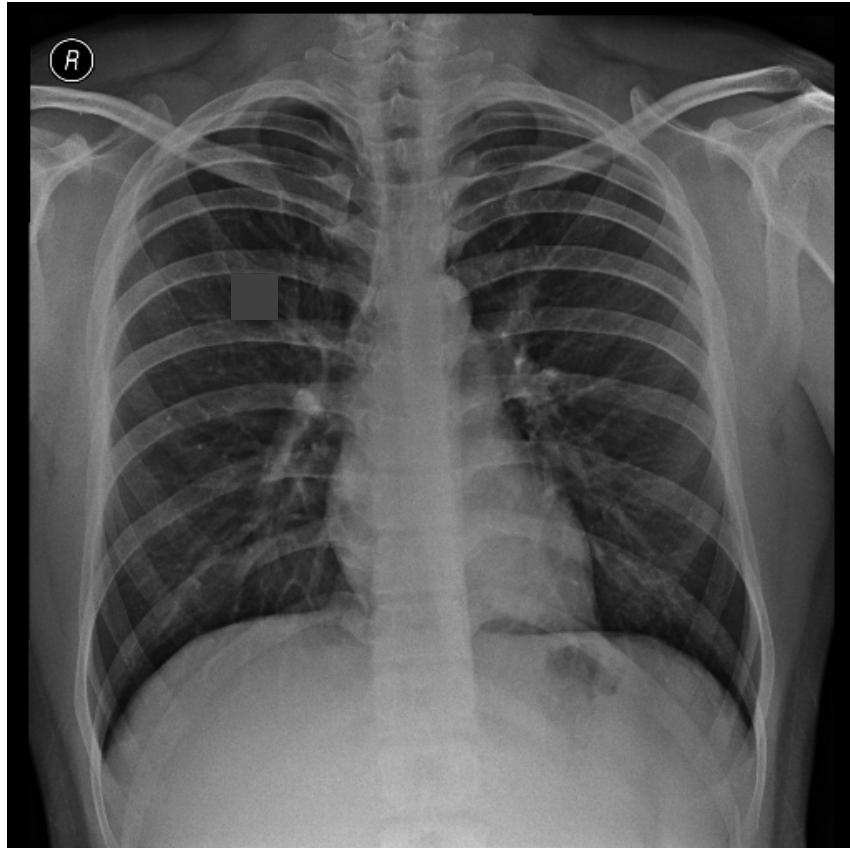
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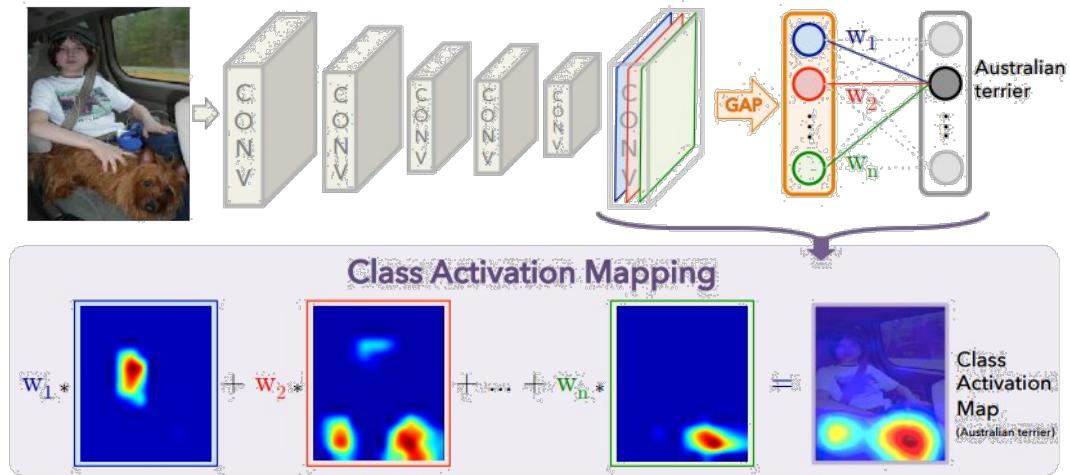


Heatmaps

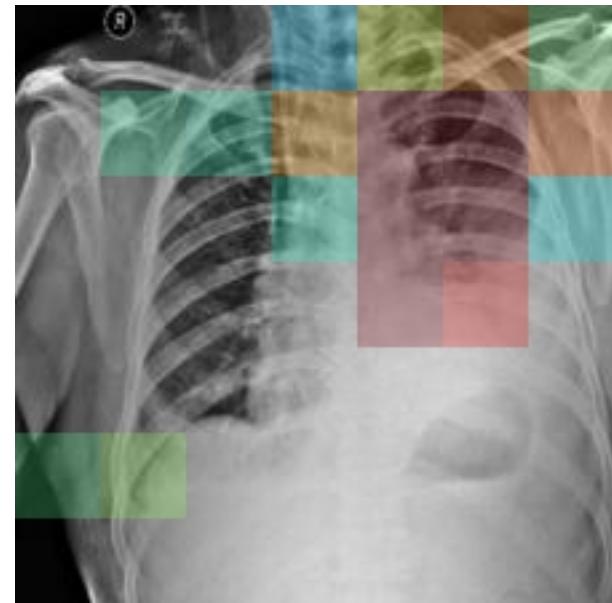
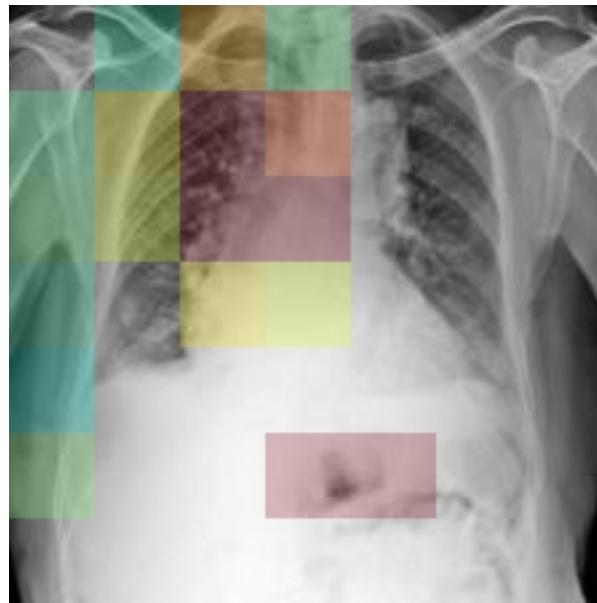
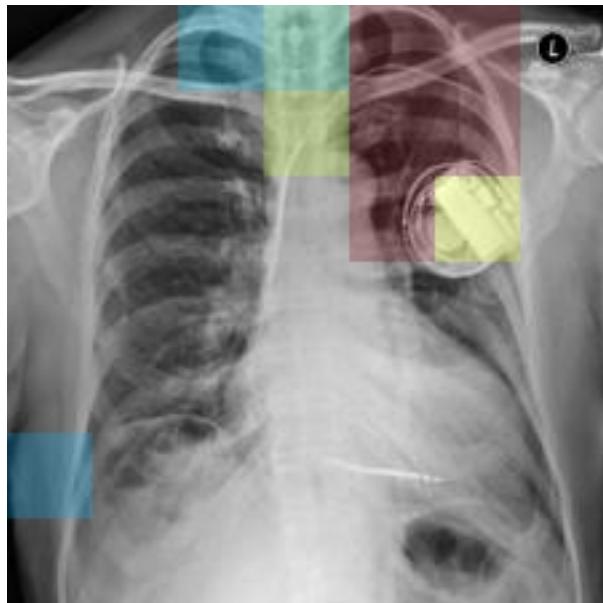
Class Activation Mapping

- A class activation map for a particular category indicates the discriminative image regions used by the CNN to identify that category. (Zhou et al., 2016)
- Grad-CAM (Selvaraju et al. 2016) is generalized version of CAM, where

$$w_k = \frac{1}{Z} \sum_i \sum_j \frac{\partial y^c}{\partial A_{ij}^k}$$



Heatmaps Results



Team



Prashant Warier,
Co-founder, CEO



Pooja Rao,
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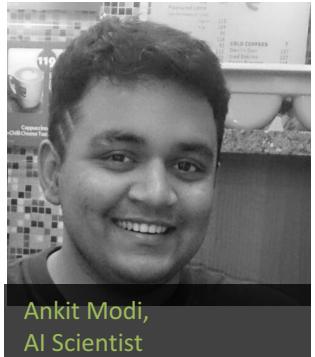
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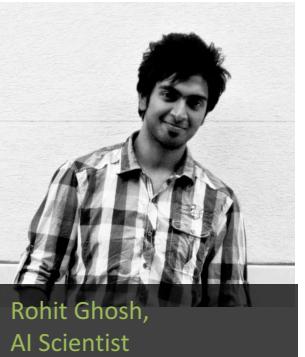
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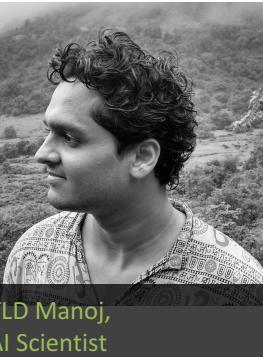
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TLD Manoj,
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References

1. t-SNE MNIST Image - [Indico Blog](#)
2. Maaten, Laurens van der, and Geoffrey Hinton. "Visualizing data using t-SNE." *Journal of Machine Learning Research* 9.Nov (2008): 2579-2605.
3. Simonyan, Karen, Andrea Vedaldi, and Andrew Zisserman. "Deep inside convolutional networks: Visualising image classification models and saliency maps." *arXiv preprint arXiv:1312.6034* (2013).
4. Zhou, Bolei, et al. "Learning deep features for discriminative localization." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2016.
5. Selvaraju, Ramprasaath R., et al. "Grad-CAM: Why did you say that?." *arXiv preprint arXiv:1611.07450* (2016).

Thank You 😊

Questions?

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Model selection using T-SNE

