Article: **Deep Mars: CNN Classification of Mars Imagery for the PDS Imaging Atlas**

Kiri L. Wagstaff1, You Lu, Alice Stanboli,
Kevin Grimes, Thamme Gowda, and Jordan Padams

Purpose:
To help people sort and search through mars images by the content of the image. They did this by adapting an Earth-image CNN to Mars images.

Methods:
1. *AlexNet image classifier* (Krizhevsky, Sutskever, and Hinton 2012)
2. *Caffe* (Jia et al. 2014), used BVLC reference model based on AlexNet, with small step
3. Developed two classifiers, one for MSL rover the other for HiRISE Mars orbiter
4. They separated photos based no Mars sol ~24hrs
5. MSL rover 24 classes, 3,000 epochs, learn rate= 0.0001, step size= 500, final layer learn rate 25
5a. Using confidence threshold of 0.9 in model elevates validation and test both over 10%
5b. For the MSL, they tried splitting between the cameras, then to classify them, but they found to have both MSL cameras images as one set gave better test results.
6. HiRISE 5 classes, used 5300 epochs, learn rate= 0.0001, stepsize= 20000, final layer learning = 10.
6a. Using confidence threshold of 0.9

Problems:
Imbalanced data for many classes for MSL causing lower scores.
Models need for more labeled data

Results:
MSL validation accuracy ~83% preformed better then test ~67%
HiRISE accuracy was ~91% for the test data

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