**Verification of Deep Convolutional Neural Network using ImageStars**

The experimental results of the paper consist of three main parts

1. Comparison of the Zonotope, Polytope and ImageStar methods on three MNIST networks.
2. Comparison of the Polytope and ImageStar methods on VGG16 and VGG19.
3. Comparison of the exact and approximate scheme of the ImageStar methods on VGG16 and VGG19.

Requirements for reproducing the results

1. Matlab 2019b
2. A Computer with > 60 GiB RAM. Note that a computer with smaller RAM cannot be used to reproduce all the results in the paper.

Install NNV

1. Clone NNV: *git clone* [*https://github.com/verivital/nnv*](https://github.com/verivital/nnv)
2. Install NNV:
   * Open Matlab
   * Go to code/nnv/
   * Run install.m

Reproduce Part I

1. Produce Figure 8.
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/MNIST\_NETS/Small
   * Run plot\_ranges.m
2. Produce Table 1.
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/MNIST\_NETS/Small
   * Run compare\_star\_absdom.m
3. Produce Table 2.
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/MNIST\_NETS/Medium
   * Run compare\_star\_absdom.m
4. Produce Table 3.
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/MNIST\_NETS/Large
   * Run compare\_star\_absdom.m
5. Produce Figure 13 in Appendix
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/MNIST\_NETS/Architecture
   * Run plot\_network\_architectures.m

Note for repoducing Part I:

When producing Table 1, 2, and 3, in the case that the reviewer run into “out of memory” problem, we suggest the reviewer to run the short version of the results by running “compare\_star\_absdom\_short.m” for each table. This script will produce a small version of the full result.

Reproduce Part II

1. Produce Table 4, VGG16 part
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG16/Compare\_Polytope\_ImageStar/
   * Run verify\_VGG16.m
2. Produce Table 4, VGG19 part
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG19/Compare\_Polytope\_ImageStar/
   * Run verify\_VGG19.m

Reproduce Part III

1. Produce Table 5, VGG16 part
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG16/Compare\_Exact\_vs\_Approx
   * Run verify\_robustness\_delta\_e\_07.m and verify\_robustness\_delta\_2e\_07.m
2. Produce Table 5, VGG19 part
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG19/Compare\_Exact\_vs\_Approx
   * Run verify\_robustness\_delta\_e\_07.m and verify\_robustness\_delta\_2e\_07.m
3. Produce Figure 9
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG19/Plot\_Figures
   * Run plot\_vgg19\_exact\_range.m
4. Produce Figure 10
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG19/Plot\_Figures
   * Run plot\_vgg19\_counter\_example.m
5. Produce Figure 11
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG19/Plot\_Figures
   * Run plot\_vgg19\_reachTime.m
6. Produce Figure 12
   * Go to code/nnv/example/Submission/CAV2020\_ImageStar/VGG19/Plot\_Figures
   * Run plot\_vgg19\_inputSize\_effect.m