

NegSelReport

Name: Yosef Berezovskiy

User-name: ttrq46

Two-letter code for your chosen negative selection algorithm: RVNS

My approach involved using the grid search technique to test a wide range of parameters. The goal was to identify the best-performing combinations.

The results showed that an increase in the number of detectors improved the detection rate. However, when the number of iterations was lower, the false alarm rate increased. I also observed that a higher maturity age for the detectors led to an increased false alarm rate. This might be because many detectors stay too close to the self-space as they mature.

During the grid search, the 'k' parameter did not show a clear pattern, so I settled on the conventional value of 3, which worked well. Experimenting with different values for the decay rate and initial decay showed that a higher initial decay generally increased the detection rate but also raised the false alarm rate. Changing the decay rate yielded varying results.

After the grid search, I used Bayesian optimization to fine-tune the parameters. The chosen combination achieved the highest detection rate (DR) and rather low false alarm rate (FAR) - 83.55% DR, 7.95%. I was considering all results that produce FAR < 10 % as satisfactory. Testing various close-to-optimal parameter combinations revealed that even with significant differences from the best set of parameters, the average performance was consistent, with about 80% detection rate and 10% false alarm rate. I was measuring averages of running RVNS 100 times on the same set of parameters and then I was measuring the average. These combinations usually had similar numbers of detectors, iterations, and temperature, but varied in decay rate and initial decay.

I also experimented with a variant of RVNS, called randomized real-valued negative selection. This version approximates and improves detector distribution but was time-inefficient and often created fewer than optimal detectors. This enhancement increased the detection rate to 90%, but also significantly increased the false alarm rate up to 30%. Due to these results, I decided to continue using the standard RVNS.

In the standard RVNS, I experimented with how to handle detectors that exceeded the data space limits. Initially, I used a clipping technique, but later found that reflecting detectors back into the data space yielded slightly better results, likely due to improved exploration. The performance was measured and compared using average metrics over 100 runs for the same sets of parameters.