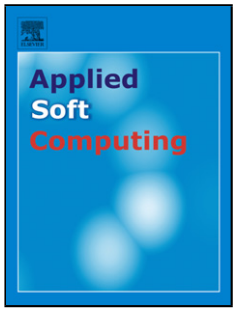

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An antigen space density based real-value negative selection algorithm

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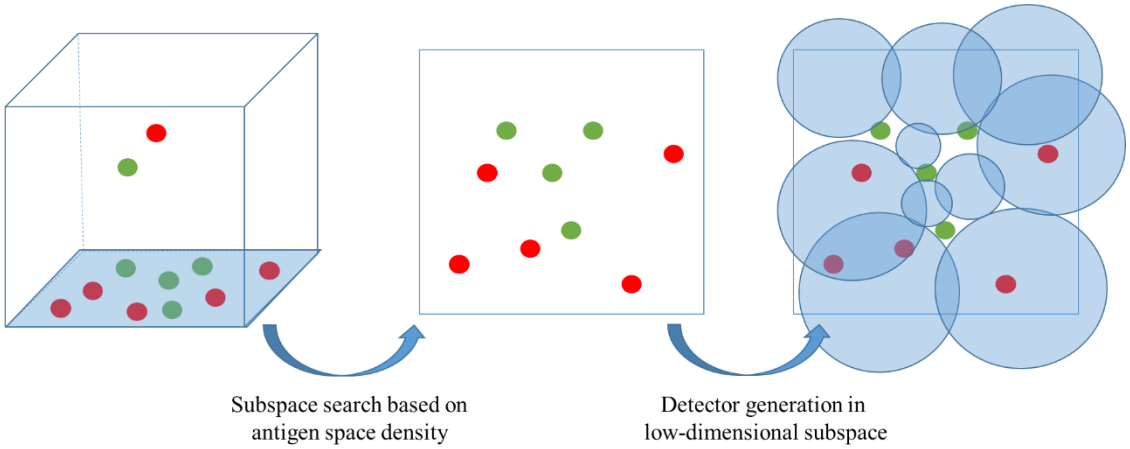
Graphical Abstract:



Highlights

- We design a new negative selection algorithm which can utilize the antigens space density to search out the low-dimensional subspaces where antigens are densely gathered and directly generate detectors in these subspaces.
- We design the "antibody suppression" method to eliminate redundant detectors.
- We proposed a new termination condition to prevent the algorithm from prematurely converging in high-dimensional space

***Abstract*—**The negative selection algorithm (NSA) is an important detector generation algorithm for artificial immune systems. In high-dimensional space, antigens (data samples) distribute sparsely and unevenly, and most of them reside in low-dimensional subspaces. Therefore, traditional NSAs, which randomly generate detectors without considering the distribution of the antigens, cannot effectively distinguish them. To overcome this limitation, the antigen space density based real-value NSA (ASD-RNSA) is proposed in this paper. The ASD-RNSA contains two new processes. First, in order to improve detection efficiency, ASD-RNSA utilizes the antigen space density to calculate the low-dimensional subspaces where antigens are densely gathered and directly generate detectors in these subspaces. Second, to eliminate redundant detectors and prevent the algorithm from prematurely converging in high-dimensional space, ASD-RNSA suppresses candidate detectors that are recognized by other mature detectors and adopts an "antibody suppression rate" to replace the "expected coverage" as the termination condition. Experimental results show that ASD-