

This paper studies the performance of the scaled largest eigenvalue (SLE) detector used for the detection of stationary time-series. We focus on a single-antenna setup and a blind detection scenario (neither the signal covariance, nor the noise variance are known). The SLE detector has received much attention in the context of cognitive radios (CR) due to its simplicity, good performance and robustness to noise level uncertainties. Specifically, our goal is to analyze the detector based on the statistic  $\Gamma = [(\lambda_1)/(\sum_{i=1}^p \lambda_i)]$ , where  $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_p$  represent the ordered eigenvalues of the sample covariance matrix. We derive a large-sample-size closed-form approximation for the test statistic which allows us to derive its statistical distribution and set up the detector to achieve the required probability of false-alarm (Pfa) and probability of detection (Pd). We also study the robustness of the detector in the presence of noise uncertainty and impulsive-noise and investigate the benefits of the spatial sign filter for such scenarios.