Concerning a closed Jackson network with $M$ servers and $N$ customers, we propose a new method to optimize the service rates. The objective is to minimize (or maximize) the customer-average performance, which is different from the traditional time-average performance. As we know, the steady-state distribution of closed Jackson networks has the product-form solution. We use this special property to aggregate the perturbation realization factors, which are fundamental concepts of the Perturbation Analysis (PA) in queueing systems. With this aggregated perturbation realization factors, we derive the performance difference equation when the service rates are changed. Then, a type of policy iteration algorithms is developed. The complexity of this algorithm (the number of aggregated perturbation realization factors) is linear to the system size, although the system state space will grow exponentially. Thus, our method survives the “dimensionality curse” of this type of problems. Simulation results demonstrate its efficiency. Our results can be viewed as a complementary method for the traditional Perturbation Analysis in queueing systems, which uses the gradient-based algorithms to do optimization.