The popular least-mean-squares (LMS) algorithm for adaptive filtering is nonrobust against impulsive noise in the measurements. The presence of this type of noise degrades the transient and steady-state performance of the algorithm. Since the distribution of the impulsive noise is generally unknown, a robust semi-parametric approach to adaptive filtering is warranted, where the output error nonlinearity is adapted jointly with the parameter of interest. In this paper, a robust adaptive filtering algorithm is developed that effectively learns and tracks the output error distribution to improve estimation performance. The performance of the algorithm is analyzed mathematically and validated experimentally.