Recently, power generation facilities are applying ICT-based big data and AI-based technologies for real-time monitoring, diagnosis and abnormal prediction. The technique for early diagnosis of equipment failure is important. In the world, the automatic diagnosis technology of power generation facilities is applied to rule-based technology or early warning technology. In this study, we describe an example of building an axial vibration monitoring system for a steam turbine, extracting a typical dynamic characteristic pattern of axial vibration, implementing an automatic diagnosis system based on machine learning, and applying it to a power plant. Turbine vibration real-time monitoring system monitors shaft vibration occurring during rotation, implements dynamic learning response patterns such as rubbing, unbalance, misalignment, and oil whirl, which are failure factors, to machine learning and to automatically diagnose abnormal signs and apply them to power plants. Shaft vibration of physical quantities such as order (1X, 2X, nX), Direct, RMS, crest factor, rotational speed, gap, and waveform when an abnormal sign of rubbing, unbalance, misalignment, or oil whip occurs. The characteristic occurs in the analysis chart. Mutual information (MI) was used to separate data groups and SVM (Support Vector Machine) was used for pattern recognition.