This letter presents a novel architecture for evaluating the success of picking operations that are executed by industrial robots. It is formed by a cascade of machine learning algorithms (kNN and SVM) and uses information obtained by a 6 axis force/torque sensor and, if available, information from the built-in sensors of the robotic gripper. Beyond measuring the success or failure of the entire operation, this architecture makes it possible to detect in real-time when an object is slipping during the picking. Therefore, force and torque signatures are collected during the picking movement of the robot, which is decomposed into five different stages that allows to characterize distinct levels of success over time. Several trials were performed using an industrial robot with two different grippers for picking a long and flexible object. The experiments demonstrate the reliability of the proposed approach under different picking scenarios since, it obtained a testing performance (in terms of accuracy) up to 99.5% of successful identification of the result of the picking operations, considering an universe of 400 attempts.