NOvA is a two detector long-baseline neutrino oscillation experiment using Fermilab's 700 kW NuMI neutrino beam. It studies the disappearance of muon (anti)neutrinos and the appearance of electron (anti)neutrinos in the beam over a distance of 810 km between the detectors. This thesis presents the latest 2020 update of the NOvA neutrino oscillation analysis within the standard model of three neutrinos mixing. With about +50% new data in NuMI neutrino mode (+22% of the total available data) and numerous analysis upgrades compared to the previously reported results, the experiment has made over 4σ-significant observation of electron antineutrino appearance in muon antineutrino beam and constrained the oscillation parameters $|\Delta m^2_{32}|, \sin^2\theta_{23}$ and δ_{CP}. The text closely depicts the analysis and all its novelties and changes. A detailed inspection is dedicated to the systematic uncertainties and their estimation and validation. Although statistical uncertainties currently dominate in these measurements, understanding the major sources of systematic uncertainties and their correlations is vital for both the interpretation and precision of the results and for further improvements of the analysis.