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Classical Homotopy Theory vs A-Homotopy Theory for Graphs

In Algebraic Topology, two spaces are homotopic if you can continuously deform one space into the other. For example, the coffee mug and the doughnut are homotopic, because we can continuously deform the cup of the mug on to the handle until it is a doughnut. Thus these two shapes have the same homotopy groups, that is, the hole formed by the handle and the doughnut hole, respectively, represent the only non-trivial generators of the homotopy groups of these shapes. When considering a graph as a topological space, the graph is homotopic to a bouquet of loops and would only be contractible, that is, homotopic to a point, if the graph was acyclic. But a graph is more than the sum of its holes. Thus A-homotopy theory was developed as a way to find the invariants in a graph while respecting the combinatorial structure of the graph.

In this poster, I will introduce the basic definitions of A-homotopy theory, discuss the motivation for studying A-homotopy theory, and give examples of how classical homotopy theory differs from A-homotopy theory, including contractible graphs, fundamental groups of graphs, and the homotopy lifting property.