Creating Persistance Homology Using Vietorial Rips and Alpha Complexes

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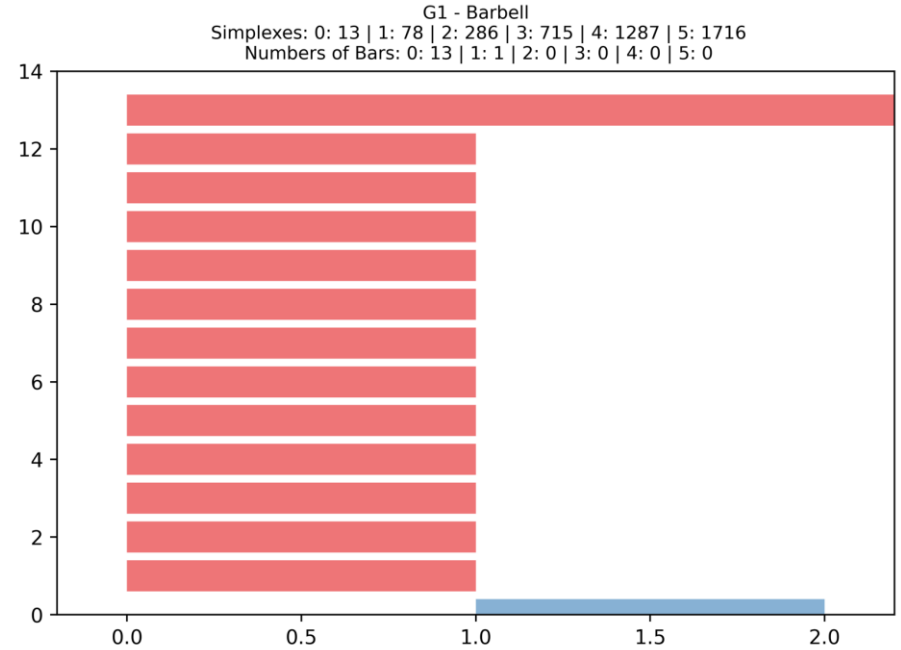
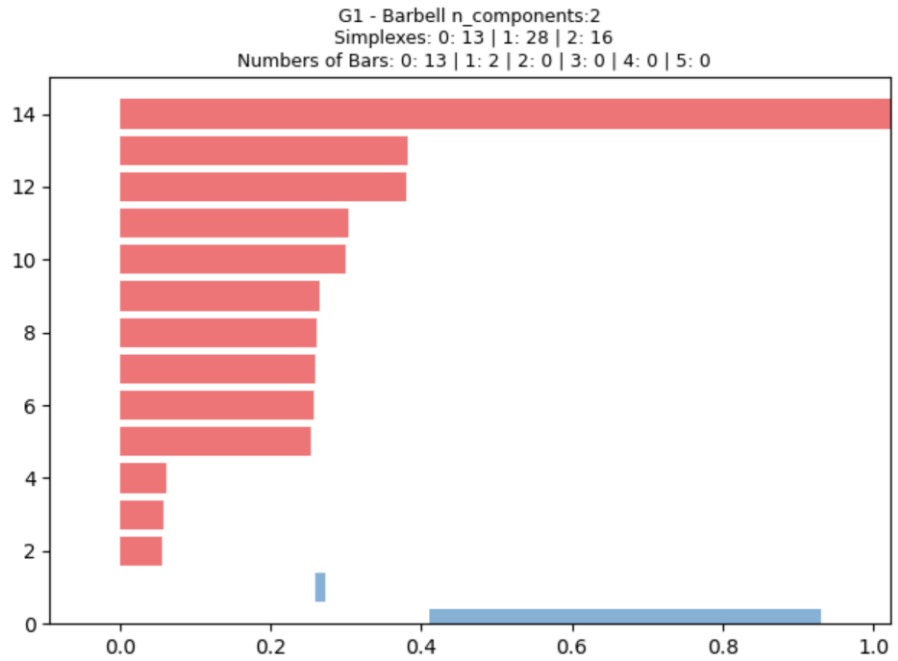
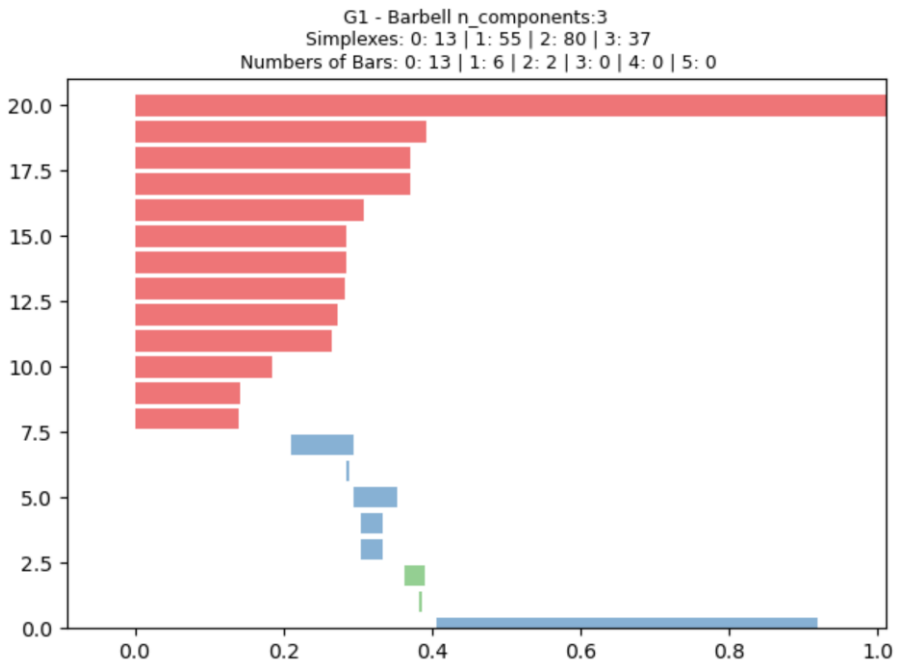
Vietorial Rips and Alpha Complexes

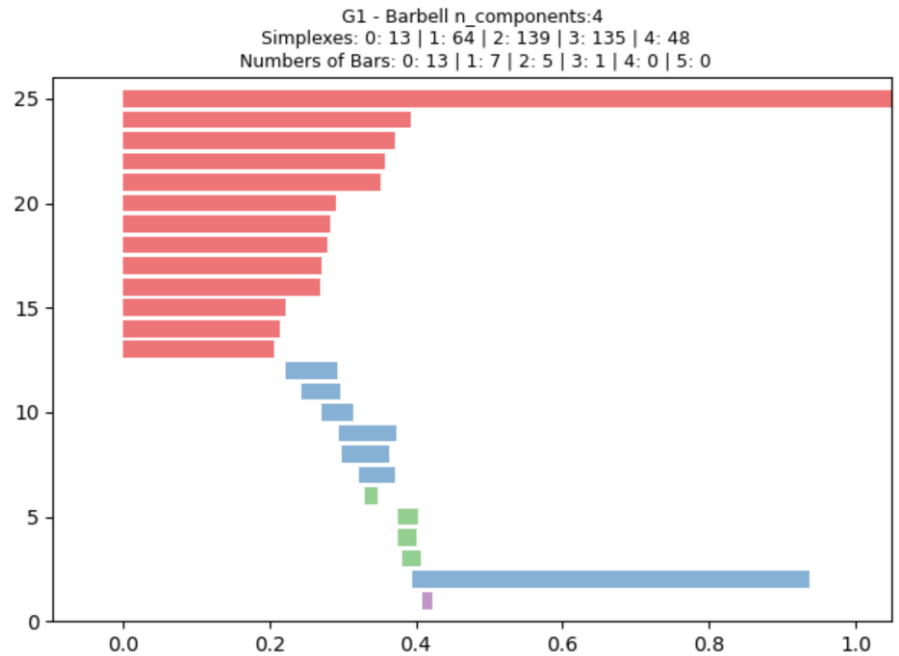
- There is a huge difference in the number of simplexes created when comparing Rips and Alpha Complexes
- This difference greatly reduces the computational time
- Alpha Complexes do not accept distance matrix as input, so we need to create an approximation in the R^N (point cloud) using multidimensional scaling (MDS)

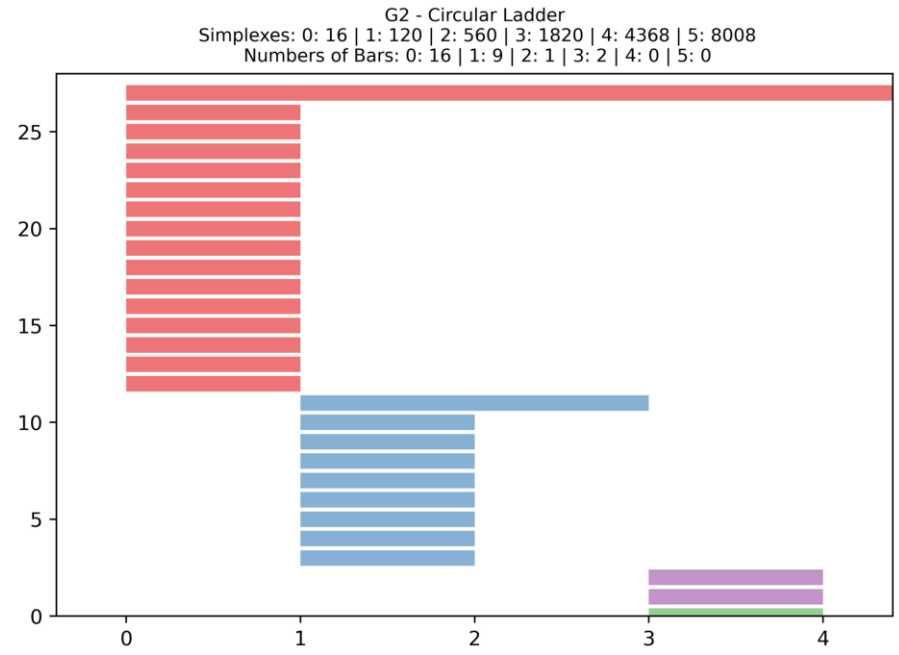
- Here, we present Persistence Homology done over a Rips and three Alpha Complexes with an approximation to the dimensions 2, 3, and 4.

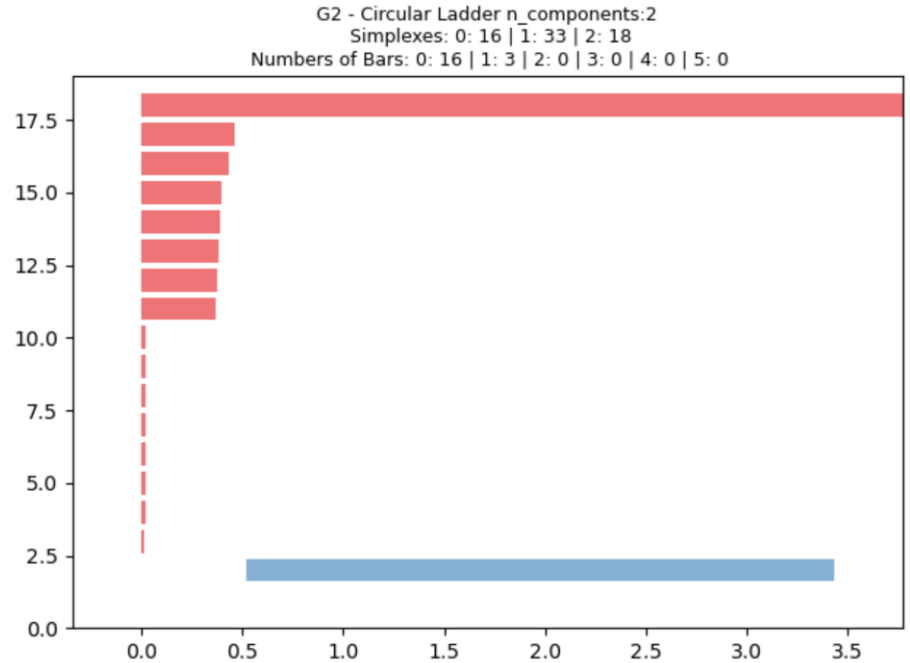

G1 - Barbell
Simplexes: 0: 13 | 1: 78 | 2: 286 | 3: 715 | 4: 1287 | 5: 1716
Numbers of Bars: 0: 13 | 1: 1 | 2: 0 | 3: 0 | 4: 0 | 5: 0

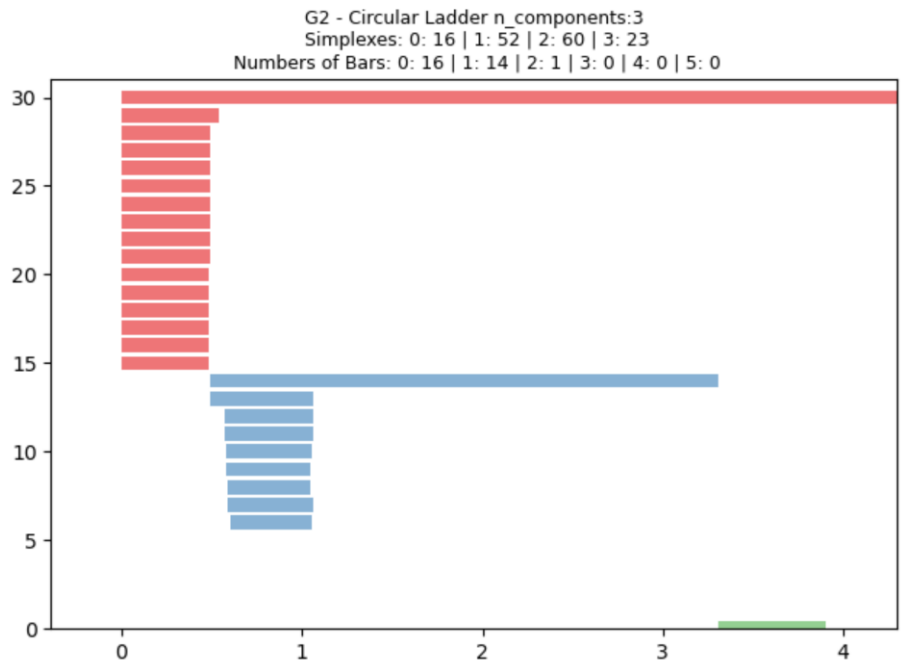

G1 - Barbell n_components:2
Simplexes: 0: 13 | 1: 28 | 2: 16
Numbers of Bars: 0: 13 | 1: 2 | 2: 0 | 3: 0 | 4: 0 | 5: 0

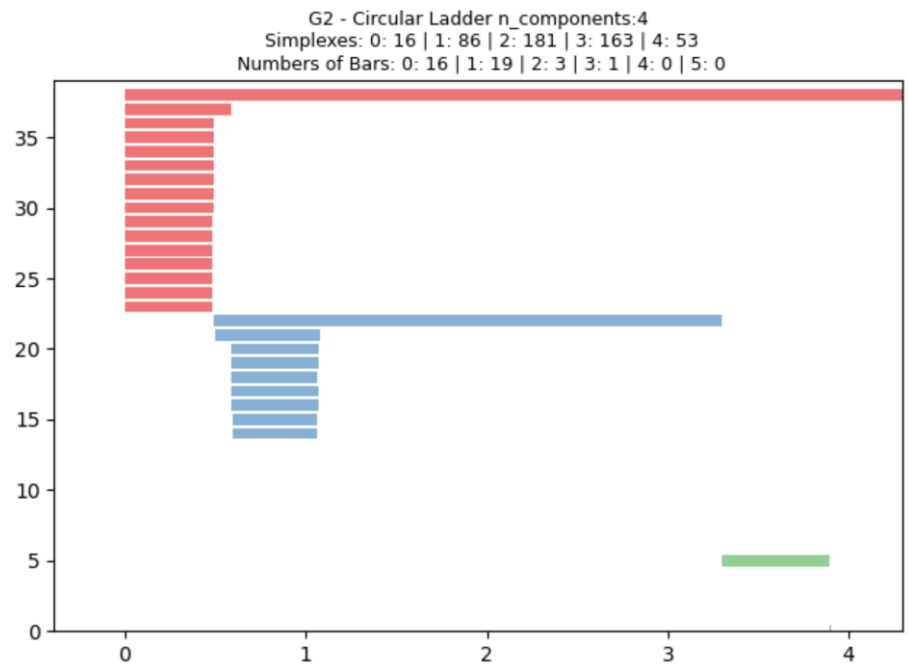

G1 - Barbell n_components:3
Simplexes: 0: 13 | 1: 55 | 2: 80 | 3: 37
Numbers of Bars: 0: 13 | 1: 6 | 2: 2 | 3: 0 | 4: 0 | 5: 0


G1 - Barbell n_components:4
Simplexes: 0: 13 | 1: 64 | 2: 139 | 3: 135 | 4: 48
Numbers of Bars: 0: 13 | 1: 7 | 2: 5 | 3: 1 | 4: 0 | 5: 0

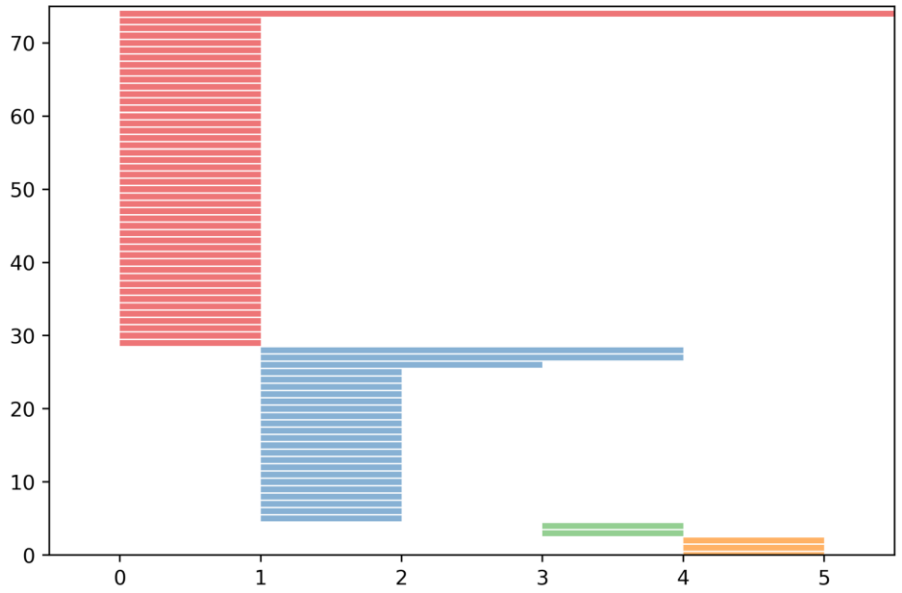

G2 - Circular Ladder
Simplexes: 0: 16 | 1: 120 | 2: 560 | 3: 1820 | 4: 4368 | 5: 8008
Numbers of Bars: 0: 16 | 1: 9 | 2: 1 | 3: 2 | 4: 0 | 5: 0


G2 - Circular Ladder n_components:2
Simplexes: 0: 16 | 1: 33 | 2: 18
Numbers of Bars: 0: 16 | 1: 3 | 2: 0 | 3: 0 | 4: 0 | 5: 0

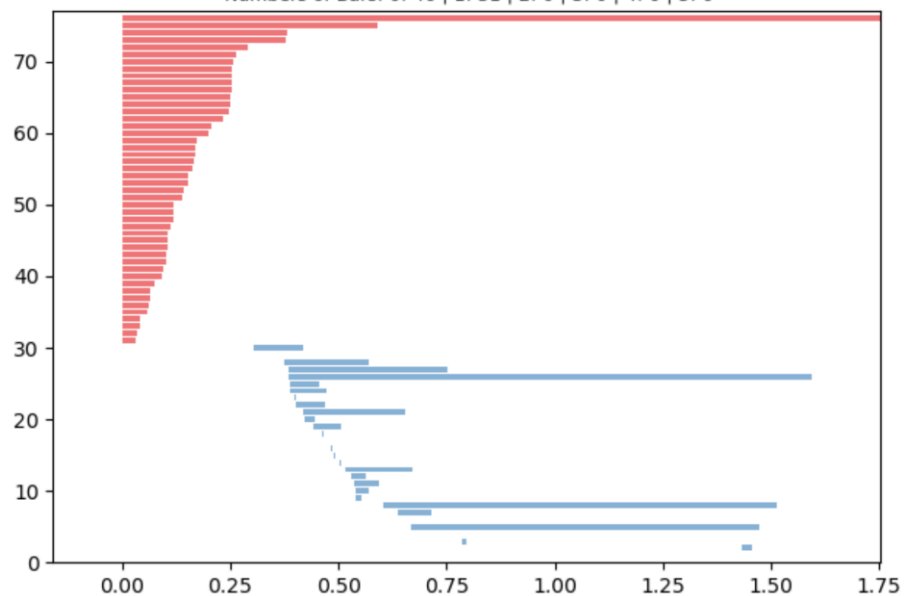

G2 - Circular Ladder n_components:3
Simplexes: 0: 16 | 1: 52 | 2: 60 | 3: 23
Numbers of Bars: 0: 16 | 1: 14 | 2: 1 | 3: 0 | 4: 0 | 5: 0


G2 - Circular Ladder n_components:4
Simplexes: 0: 16 | 1: 86 | 2: 181 | 3: 163 | 4: 53
Numbers of Bars: 0: 16 | 1: 19 | 2: 3 | 3: 1 | 4: 0 | 5: 0

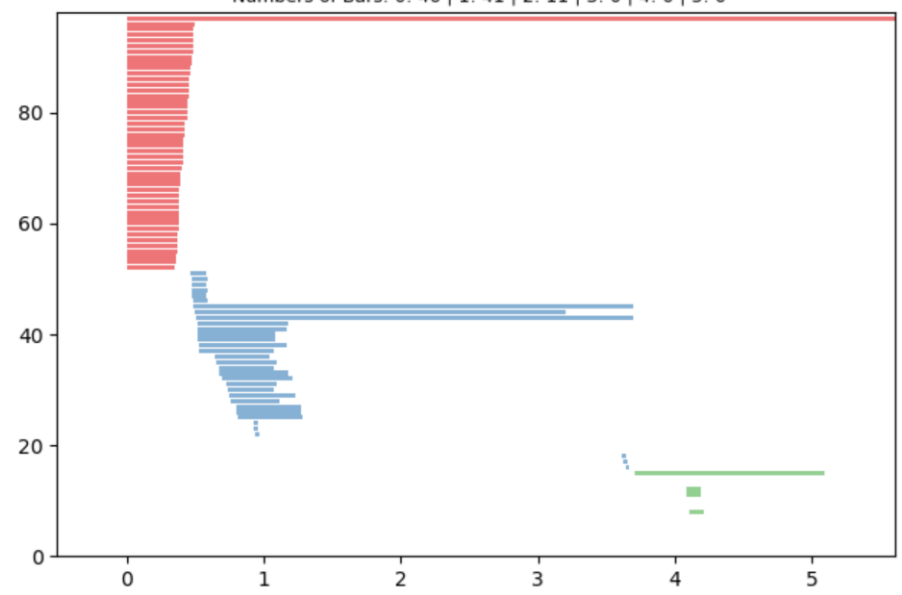
G3 - Tutte Graph
Simplexes: 0: 46 | 1: 1035 | 2: 15180 | 3: 163185 | 4: 1370754 | 5: 9366819
Numbers of Bars: 0: 46 | 1: 24 | 2: 2 | 3: 0 | 4: 3 | 5: 0



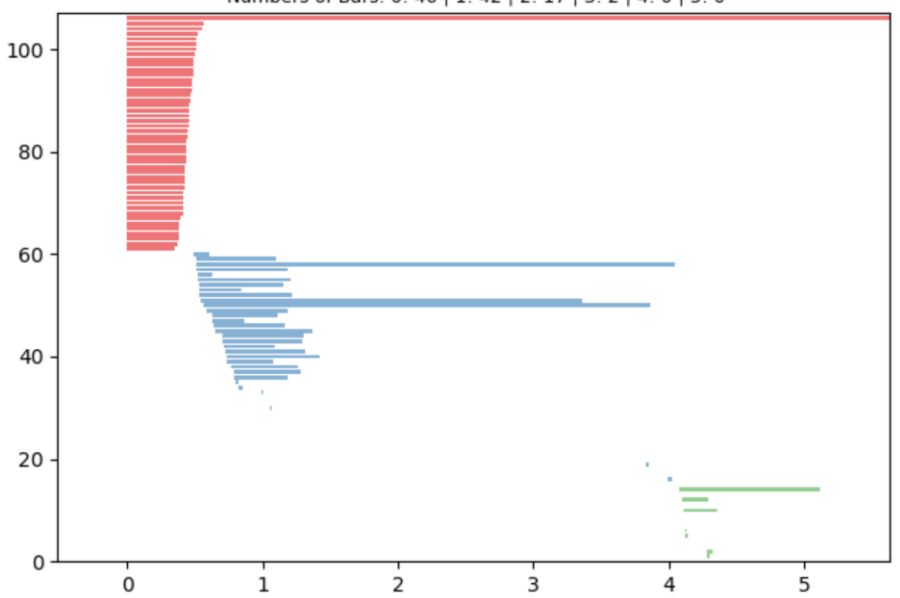
G3 - Tutte Graph n_components:2
Simplexes: 0: 46 | 1: 125 | 2: 80
Numbers of Bars: 0: 46 | 1: 31 | 2: 0 | 3: 0 | 4: 0 | 5: 0

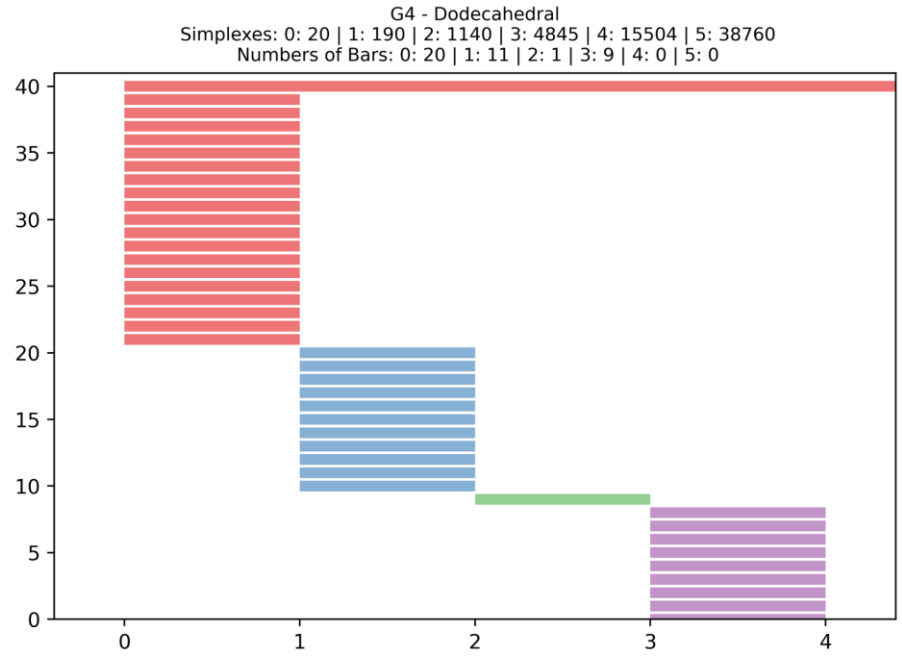


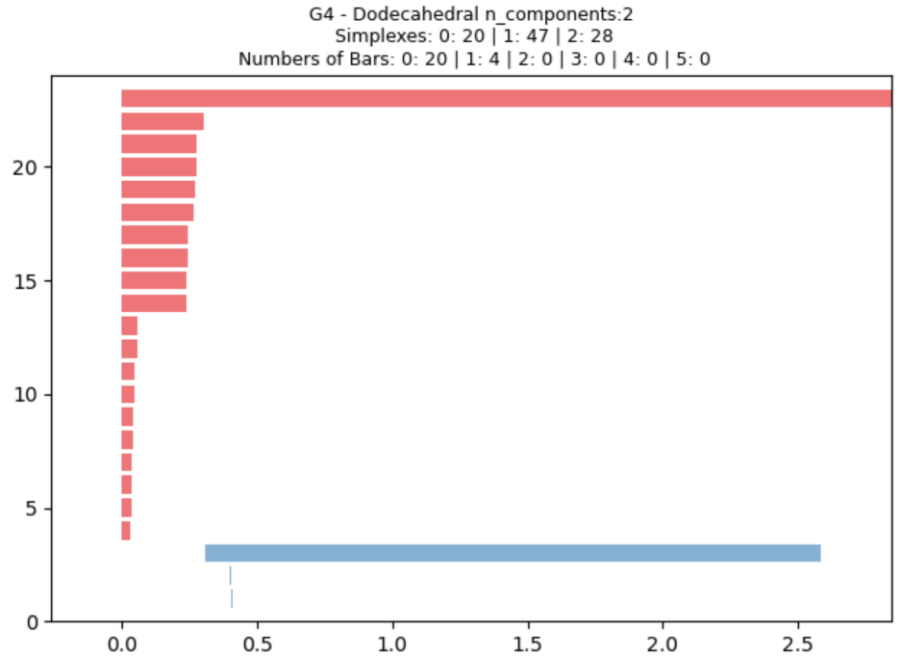
G3 - Tutte Graph n_components:3
Simplexes: 0: 46 | 1: 283 | 2: 445 | 3: 207
Numbers of Bars: 0: 46 | 1: 41 | 2: 11 | 3: 0 | 4: 0 | 5: 0

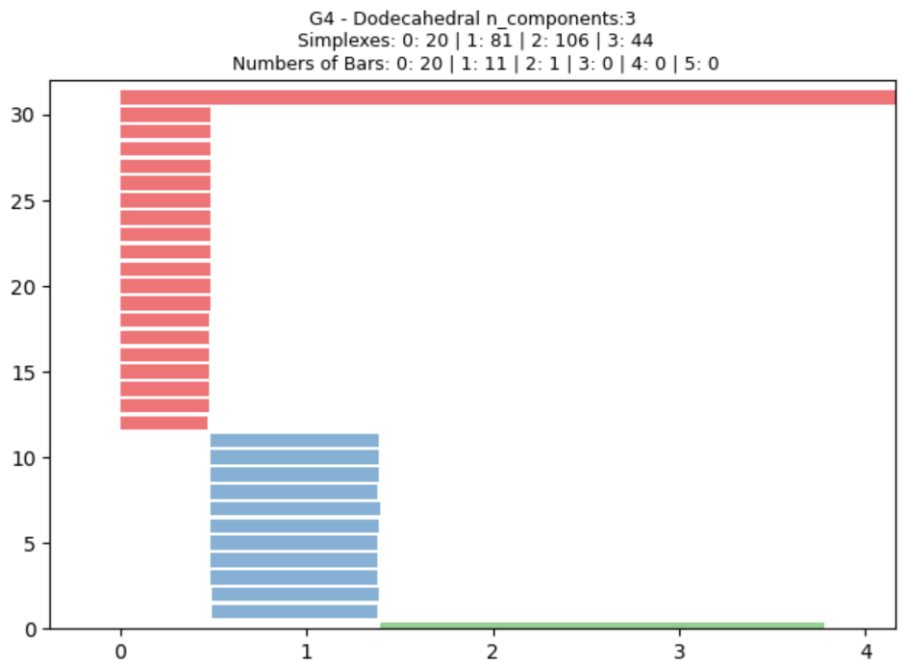


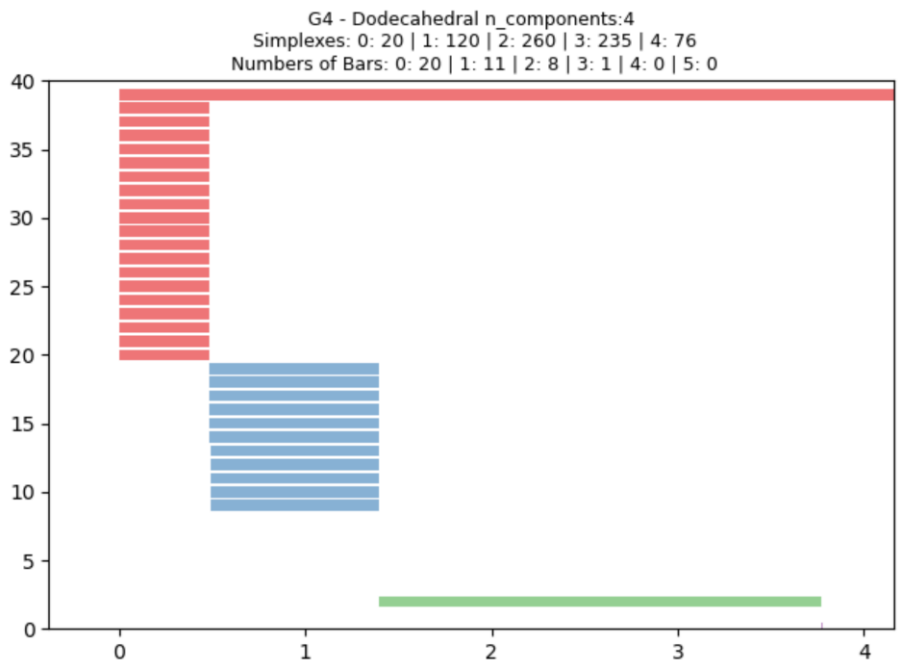
G3 - Tutte Graph n_components:4
Simplexes: 0: 46 | 1: 493 | 2: 1450 | 3: 1607 | 4: 605
Numbers of Bars: 0: 46 | 1: 42 | 2: 17 | 3: 2 | 4: 0 | 5: 0




G4 - Dodecahedral
Simplexes: 0: 20 | 1: 190 | 2: 1140 | 3: 4845 | 4: 15504 | 5: 38760
Numbers of Bars: 0: 20 | 1: 11 | 2: 1 | 3: 9 | 4: 0 | 5: 0


G4 - Dodecahedral n_components:2
Simplexes: 0: 20 | 1: 47 | 2: 28
Numbers of Bars: 0: 20 | 1: 4 | 2: 0 | 3: 0 | 4: 0 | 5: 0


G4 - Dodecahedral n_components:3
Simplexes: 0: 20 | 1: 81 | 2: 106 | 3: 44
Numbers of Bars: 0: 20 | 1: 11 | 2: 1 | 3: 0 | 4: 0 | 5: 0


G4 - Dodecahedral n_components:4
Simplexes: 0: 20 | 1: 120 | 2: 260 | 3: 235 | 4: 76
Numbers of Bars: 0: 20 | 1: 11 | 2: 8 | 3: 1 | 4: 0 | 5: 0