Oriented valuated matroids and real tropical linear spaces

Matroids can be viewed as combinatorial abstractions of linear spaces. This paradigm can be refined by imbuing the matroid with addition data. Key examples are oriented matroids, imbued with sign data, which can be seen as abstractions of real linear spaces, and valuated matroids, imbued with valuation data, as abstractions of non-Archimedean linear spaces. If we imbue a matroid with both sign and valuation data, we obtain an *oriented valuated matroid* as an abstraction of a real non-Archimedean linear space.

One motivation for studying oriented valuated matroids comes from real tropical geometry. As tropical geometry is the combinatorial shadow of algebraic geometry, real tropical geometry is the combinatorial shadow of real algebraic geometry. A 'classical' result of tropical geometry is that a tropical linear space is precisely the space of covectors of a valuated matroid. This gives access to a host of geometric and polyhedral tools to study the structure of valuated matroids. Similarly, a real tropical linear space is the space of covectors of an oriented valuated matroid. We will use this correspondence as a jumping off point to study the combinatorial, geometric and topological properties of oriented valuated matroids.

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