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Scale-invariant random spatial networks

We study the implications of assuming scale-invariance in a mathematical model of road networks. Intuitively, scale-invariance says that the statistics of the network within a window of an online map do not depend on whether the width is 5 miles or 500 miles. Mathematically, scale-invariance forces us to work in the continuum rather than (as in most existing models of spatial networks) on discrete vertex-sets, raising novel foundational issues. One interesting consequence of scale-invariance is a convenient quantification of where a given road section lies on the major road - minor road spectrum. In particular, we introduce a non-obvious numerical statistic $p(1)$ (perhaps very loosely analogous to entropy as a non-obvious statistic of a stationary process?) measuring the density of long-distance routes. This has an intriguing connection with the effectiveness of the route-finding algorithms used by your car's GPS device.