ABSTRACT
Skyhook Wireless provides hybrid positioning to millions of mobile devices around the world. Using an approach that integrates cell, WiFi, and GPS signals, the system services over 500 million location requests daily. This results in a massive and perpetually growing artifact of device locations anchored in time and place. Using this time-stamped location data, we are able to measure aggregated mobile device activity with extreme local accuracy, to any required resolution, across thousands of cites worldwide.

Providing location services to such a large population of devices allows Skyhook to continuously improve positioning quality by reconciling signal maps returned from adjacent requests. It also provides an unparalleled tool for quantifying social behavior in space and time. We describe one analytical output of these data – SpotRank - which presents a normalized week of discrete, measured hours across the entire global Skyhook service area.

SpotRank provides a method to compare and analyze locations aggregated to .001 decimal degree tiles (approximately 1 hectare at mid latitudes) in 1-hour increments. The SpotRank “canonical week” provides an averaged measure of activity for each tile-hour: 168 hours across more than 10 million tiles. This architecture permits many creative comparisons, such as how a typical activity level varies between Monday at 9AM and Friday at 9AM for any tile in our coverage area. These normalized data may also be compared using tiles in disparate cities or countries. With these data as the baseline, many predictive and anomalous behavior analyses are possible, using SpotRank standalone metric or in concert with local data sources.

SpotRank (red, graduated circles) with constituent canonical week requests (as individual dots with density layer) beneath. Density shading begins at 1k/requests per week per hectare isoline.
Figure 1: Friday night activity in San Francisco. 
Single hour: 76.5k location requests

Figure 2: Friday 24-hour activity in San Francisco. 
24 hours: 1.215m location requests

Figure 3: Yankee Stadium, Brooklyn, NY, no game: 
24 hours: 0.94k location requests

Figure 4: Yankee Stadium, game 
24 hours: 9.13k location requests