GPS Trajectory Data Enrichment Based on a Latent Statistical Model

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Goal

GPS trajectory data enrichment
• Interpolation
• Traveling mode estimation

Key Idea

Moving behavior can be changed according to the traveling mode even between the two same locations.

Proposed Latent Statistical Model

Trajectory $x = \langle g_1, g_2, \ldots, g_l \rangle$

Location sequence $<g_1, g_2, \ldots, g_l>$

Traveling mode $m \sim \text{Multi}(\theta_g)$

Moving direction $d \sim \text{Multi}(\varphi_g)$

Travel time $t \sim N(\mu_{gt}, \sigma_{gt}^2)$

Traveling mode seq. $<m_1, m_2, \ldots, m_l>$

Interpolation Method

Total traveling time $t_S \sim N(\sum \mu_{gt}, \sum \sigma_{gt}^2)$

Interpolation Test in 3 x 5 grid settings assuming shortest path.
Interpolation accuracy 78.8%
(38,695 success/49,092 cells)

Mode estimation accuracy 12.9%
(184 success/1,427 correct interpolations)

References