Large-scale Geosocial Microsimulation

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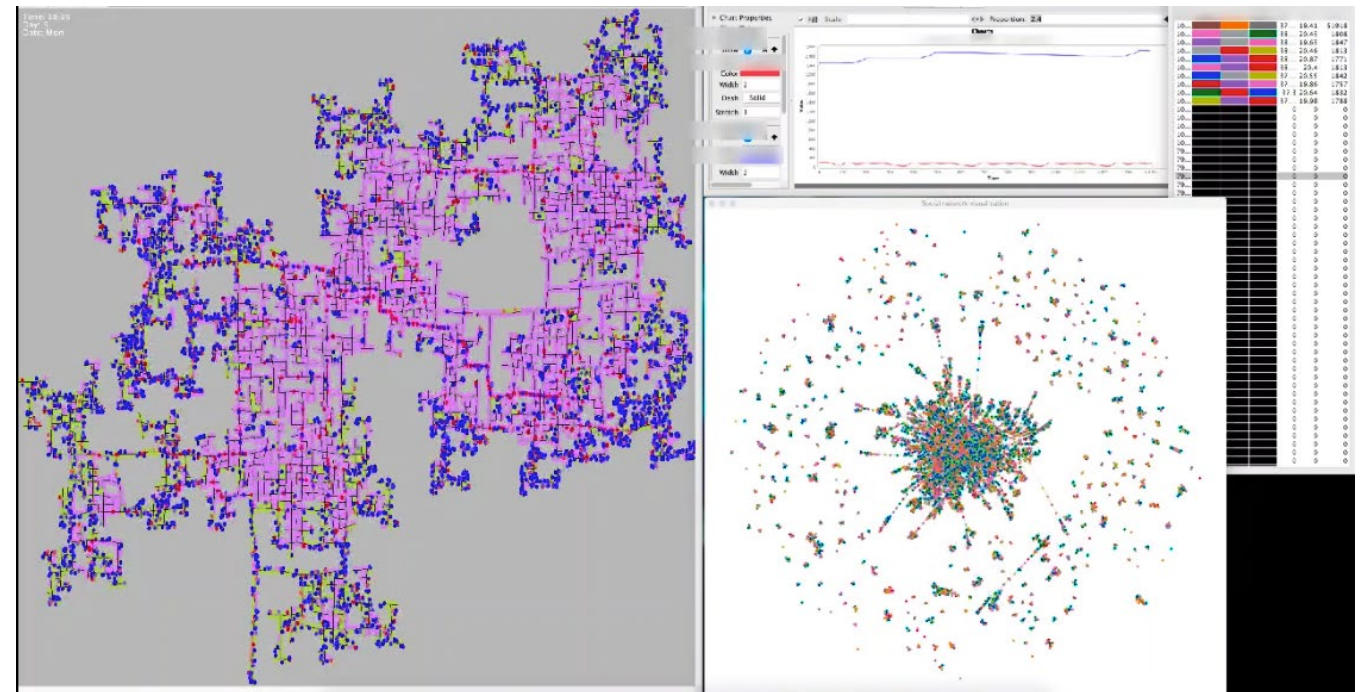**Joon-Seok Kim, Svitlana Volkova (PNNL)**

Patterns of Life Simulation

- Agent-Based Simulation
- Spatial Networks
  - Road Network & Points of Interest
- Social Networks
- Plausible Behavior
- Sandbox for Social Scientists
- Known *Ground Truth*

Large Trajectory Data Generation

- ## Millions of Check-ins
  - *Between individual agents and locations*
- ## Millions of Social Links
  - *Between individual agents*
- ## Thousands of Agents
- ## Years of Simulation Time
- ## Transferable to new locations
  - *Using OpenStreetMap*

List of Datasets Generated and Published in [1]

Settings	Period (mo.)	# of CheckIns	# of Links	Runtime (min)	Size (MB)
GMU-1K	15	2,082,788	9,114,337	53	398
GMU-1K	121	16,210,909	75,747,439	372	3,235
GMU-3K	15	6,229,293	27,650,685	342	1,247
GMU-5K	15	11,189,377	54,250,961	1,099	2,389
NOLA-1K	15	2,099,867	9,160,459	52	400
NOLA-1K	221	29,597,885	141,425,945	774	5,502
NOLA-3K	15	6,886,573	27,284,999	362	1,282
NOLA-5K	15	12,007,415	48,710,881	1,233	2,284
TownS-1K	15	2,101,620	7,643,374	44	359
TownS-3K	15	6,454,785	26,364,057	319	1,227
TownS-5K	15	10,760,008	45,118,825	867	2,093
TownL-1K	15	2,030,688	6,418,473	49	320
TownL-3K	15	6,340,360	22,655,915	400	1,109
TownL-5K	15	10,548,956	40,431,579	942	1,937

[1] Kim, Joon-Seok, Hyunjee Jin, Hamdi Kavak, Ovi Chris Rouly, Andrew Crooks, Dieter Pfoser, Carola Wenk, and Andreas Züfle. "*Location-based social network data generation based on patterns of life*." In 2020 21st IEEE International Conference on Mobile Data Management (MDM), pp. 158-167. IEEE, 2020.
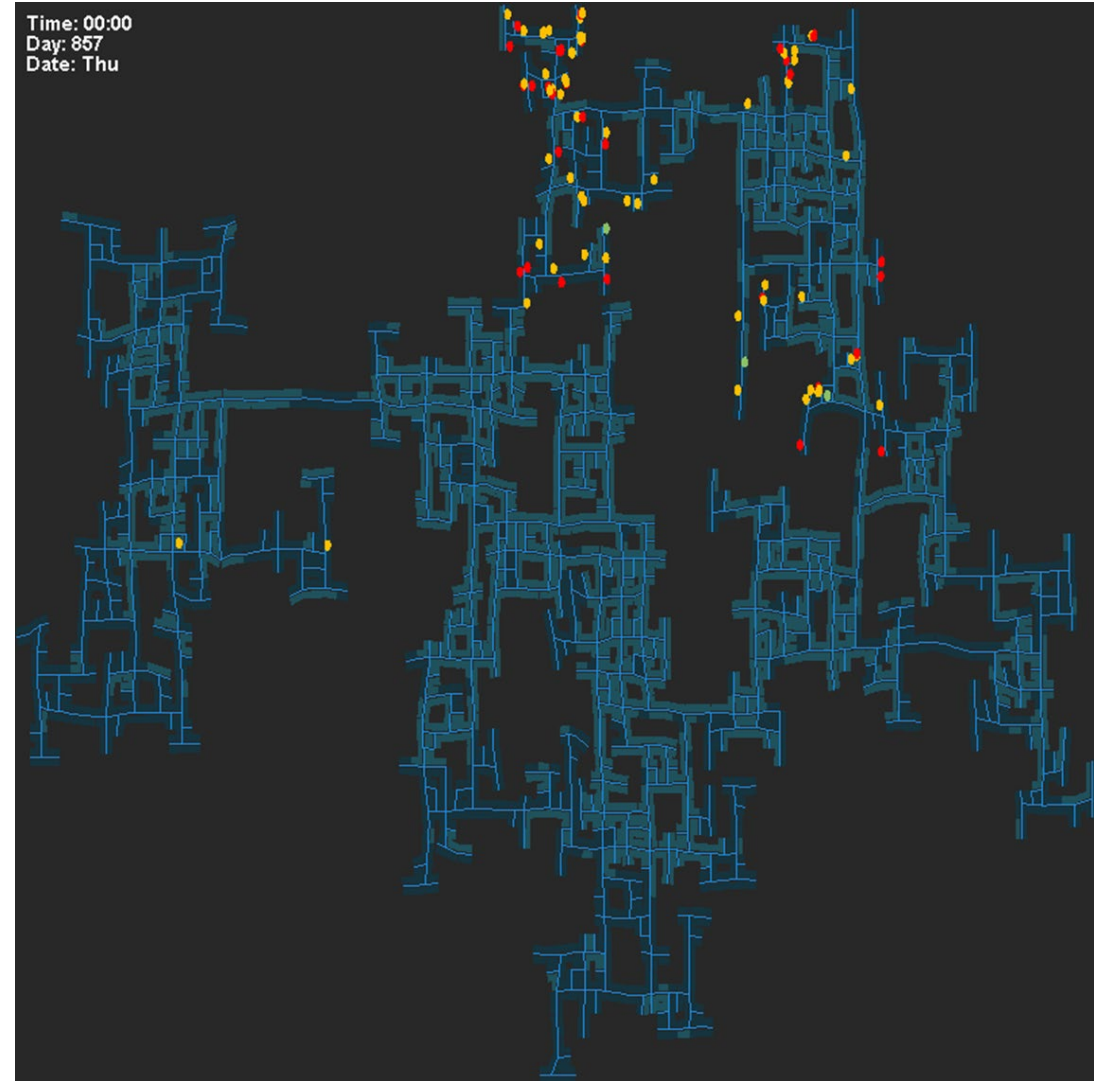
Example Challenge
- Given Trajectories of 10,000 agents
- Given information of Infectious Agents (red dots)
- Infer/Predict Exposed Agents (orange dots)

Capabilities

- ## Large-Scale Geosocial Microsimulations
  - Thousands of Agents
  - Years of Simulation Time
  - Spatially and Socially Explicit

- ## Generation of Massive Trajectory Datasets
  - Trajectories in Location-Space, Social-Space, and Time

- ## Customizable to Add New Behavior
  - Normal Behavior
  - Abnormal Behavior (infected, malicious)