

Fast Bike Trips Analysis

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Problem Statement

- **Goal:** Detect fast point-to-point bike trips.
- **Data:** Real-world bike sharing data and OpenStreetMap routes.
- **Questions:**
 - When and where do fast trips occur?
 - Who makes fast trips: members or casual users? Classic or electric bikes?
 - How well does parallel processing improve route calculations?

Solution: Fast Trip Detection

Trip Filtering and Detection:

- Exclude trips with missing station or unusual duration.
- Estimate optimal route durations using OSMnx + NetworkX. (slow!)
 - Uses actual maps, not just euclidean distance/speed
- A trip is **fast** if actual duration $< 110\%$ of optimal.

Parallelization:

- Implemented using multiprocessing.Process, Queue, and Manager for shared state.
- **Reader**: loads and filters data, pushes tasks to a shared queue.
- **Workers**: compute optimal paths with caching.

Results: User and Bike Type

User Type Distribution:

	All Rides	Fast Rides	% Fast
Member	1,204,275	90,779	7.54
Casual	546,765	27,753	5.08

Bike Type Distribution:

	All Rides	Fast Rides	% Fast
Classic	1,123,365	29,511	2.63
Electric	596,651	88,695	14.87
Docked	31,024	326	1.05

- Members are more likely to ride fast.
- Electric bikes dominate among fast trips - inherit property from being faster.

Results: Temporal Patterns

Monthly Distribution:

Month	All Rides	Fast Rides	% Fast
Jan	33,112	2,185	6.60
Feb	5,951	254	4.27
Mar	77,867	4,561	5.86
Apr	112,931	6,336	5.61
May	157,816	8,334	5.28
Jun	215,967	11,691	5.41
Jul	246,003	14,177	5.76
Aug	248,006	14,698	5.93
Sep	242,216	14,681	6.06
Oct	203,819	17,235	8.46
Nov	122,037	13,776	11.29
Dec	85,315	10,604	12.43

- Fast trip share increases in colder months.

Results: Weekly Patterns

Day	All Rides	Fast Rides	% Fast
Monday	231,290	17,650	7.63
Tuesday	263,284	19,923	7.57
Wednesday	270,499	19,768	7.31
Thursday	259,312	18,700	7.21
Friday	253,409	17,210	6.79
Saturday	255,348	13,403	5.25
Sunday	217,898	11,878	5.45

- Weekdays show higher fast ride ratios —likely commuter trips.

Results: Route Map

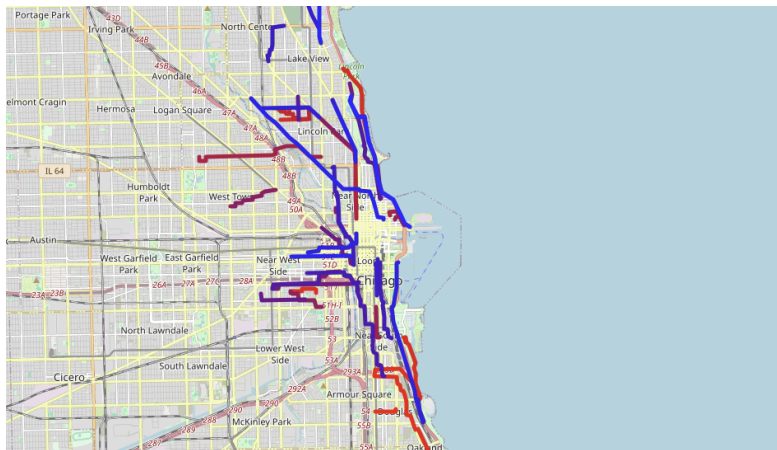
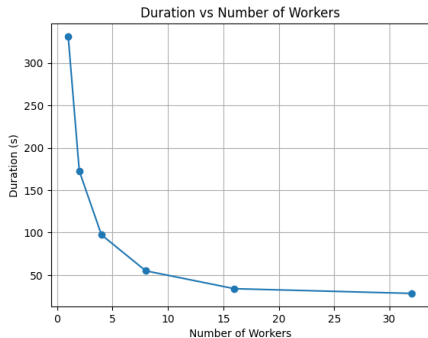
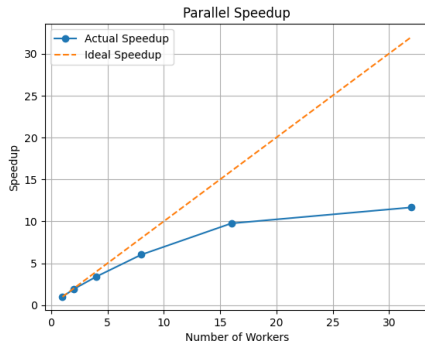


Figure: Top 50 fast trips routes: forming corridors between city center and outer stations.

Parallelization Results



Duration by worker count



Speedup compared to baseline

- Parallel processing significantly reduced runtime.
- These plots are for 1/20 of total data.