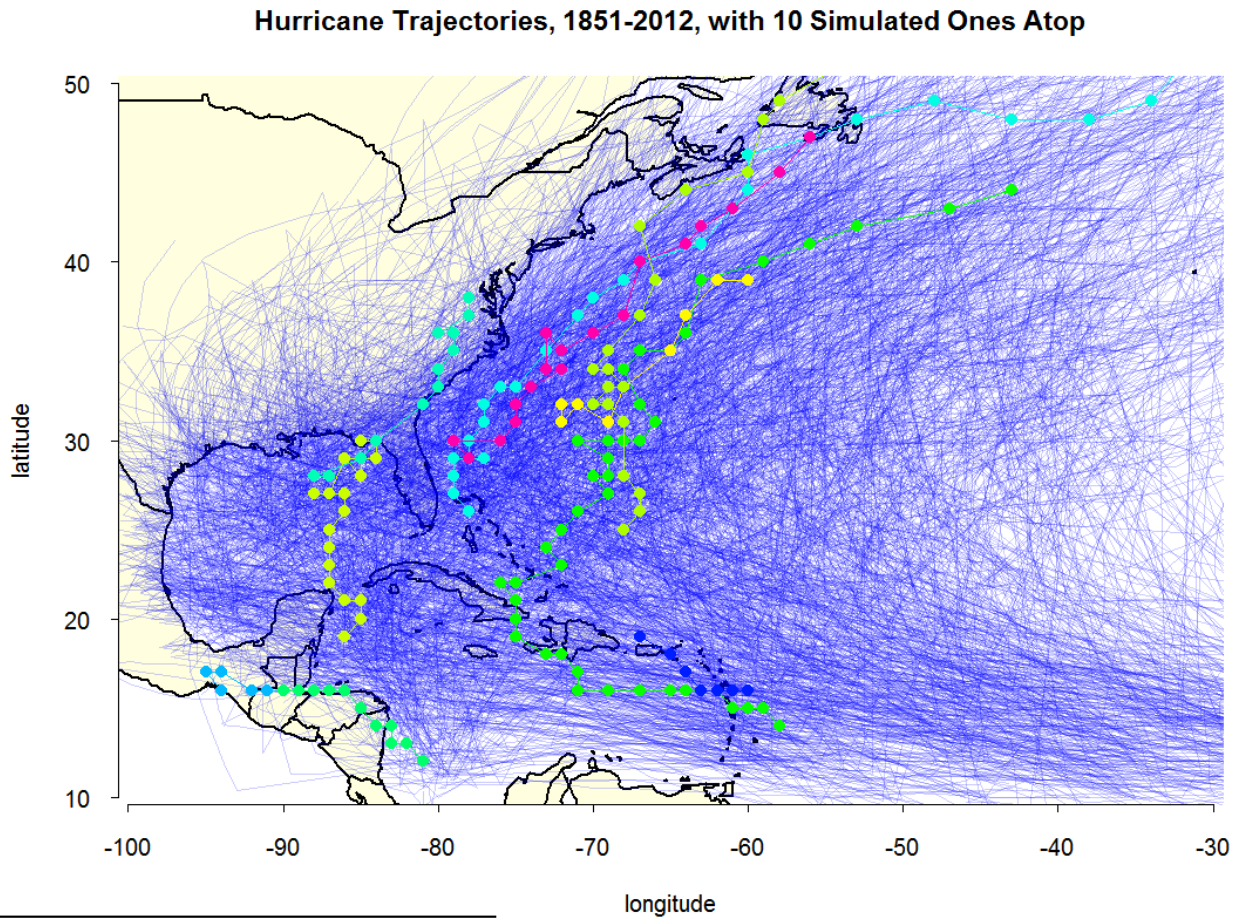
Towards Parallel Detection of Moving Flock Patterns in Large Spatiotemporal Datasets

Andres Calderon

December 1, 2016

Trajectory Datasets

- Sensors, sensors everywhere...
  - Smart phones, GPS, RFID, WiFi, Bluetooth, IoT, Remote sensing...



http://tinyurl.com/h4mbvxz

Applications

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Taxi Service Trajectory
Prediction Challenge @ ECML PKDD 2015

Completed • $250 • 381 teams

ECML/PKDD 15: Taxi Trajectory Prediction (I)

Mon 20 Apr 2015 – Wed 1 Jul 2015 (17 months ago)

Dashboard

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- Make a submission

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Forum

Kernels
- New Script
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Leaderboard
- Public
- Private

Private Leaderboard

1. ▯
2. ISFA_team
3. kc
4. Fluxus
5. lebroschar
6. H2O.ai & SRK
7. BlueTaxi

Competition Details » Get the Data » Make a submission

Predict the destination of taxi trips based on initial partial trajectories

The taxi industry is evolving rapidly. New competitors and technologies are changing the way traditional taxi services do business. While this evolution has created new efficiencies, it has also created new problems.

One major shift is the widespread adoption of electronic dispatch systems that have replaced the VHF-radio dispatch systems of times past. These mobile data terminals are installed in each vehicle and typically provide information on GPS localization and taximeter state. Electronic dispatch systems make it easy to see where a taxi has been, but not necessarily where it is going. In most cases, taxi drivers operating with an electronic dispatch system do not indicate the final destination of their current ride.

http://tinyurl.com/jfm8qfu

Applications

Research | Research areas | Products & Downloads | Programs & Events | People | Careers | About

GeoLife: Building Social Networks Using Human Location History

Established: February 6, 2009

GeoLife is a location-based social-networking service, which enables users to share life experiences and build connections among each other using human location history. Dr. Yu Zheng started this project in 2007 with his team.

Application Scenarios

- GeoLife enables user to share travel experience using GPS trajectories.
- By mining multiple users' location histories, GeoLife can discover the top most interesting locations, classical travel sequences and travel experts in a given geospatial region, hence enable a generic travel recommendation.
- By understanding individual location history, GeoLife can measure the similarity between users and perform personalized friend & location recommendation.

People

Yu Zheng
Research Manager
Urban Computing Group, Microsoft Research

Xing Xie
Senior Research Manager

http://tinyurl.com/hpd4nxl

Applications

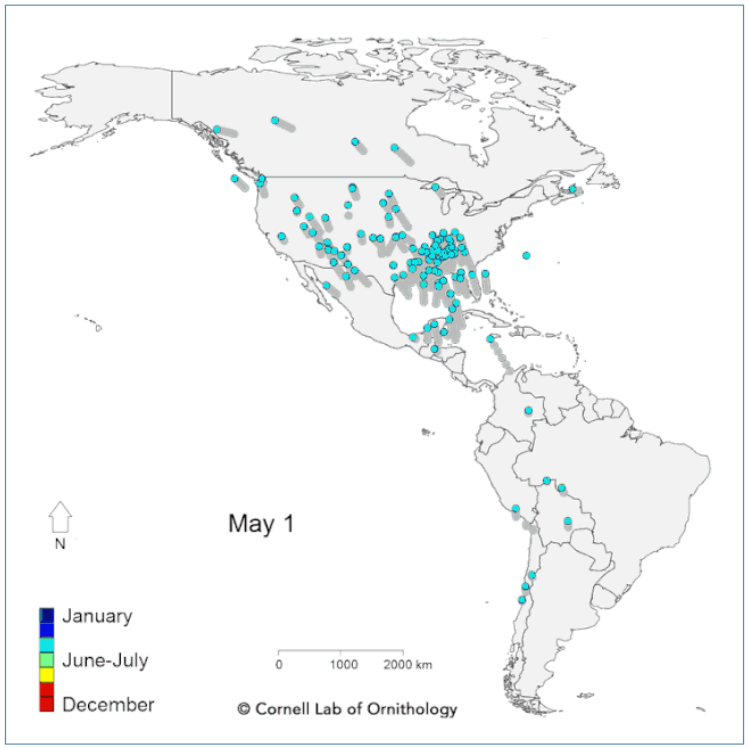
SATURDAY, JANUARY 23, 2016

eBird animated migration map

An animated map of the Western Hemisphere shows the paths of more than 100 bird populations as they migrate throughout the year.

The map was created by researchers at the Cornell Lab of Ornithology, who plotted the routes of these groups to understand their paths across land and the open ocean.

As revealed in the moving map, the team found wide similarities in the migration routes of different groups of species.



Color-coded dots show the trajectories of these birds as they head southward in the fall. Dark blue dots show the birds during January, with light green representing June-July, and red showing December.

http://tinyurl.com/hkc6ahl

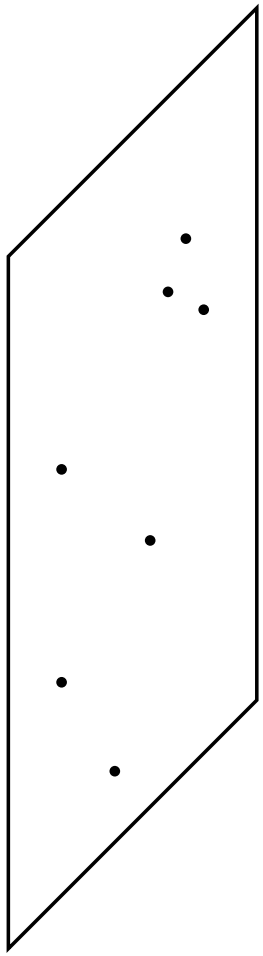
Outline

What is a flock???

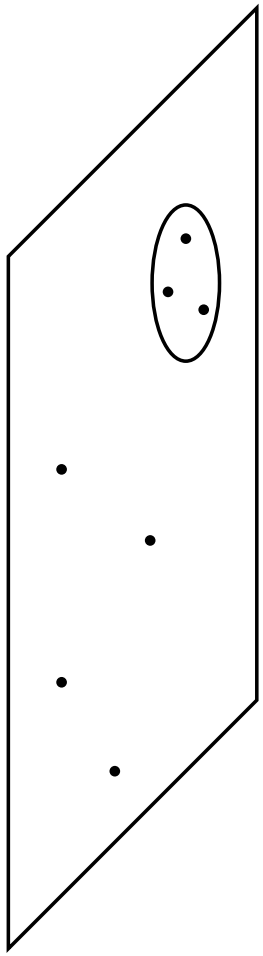
Definition $((\mu, \epsilon, \delta) - \textit{flock})$

Sets of at least μ objects moving close enough (ε) for at least δ time intervals (Benkert et al, 2008).

BFE algorithm (Vieira et al, 2009)



BFE algorithm (Vieira et al, 2009)



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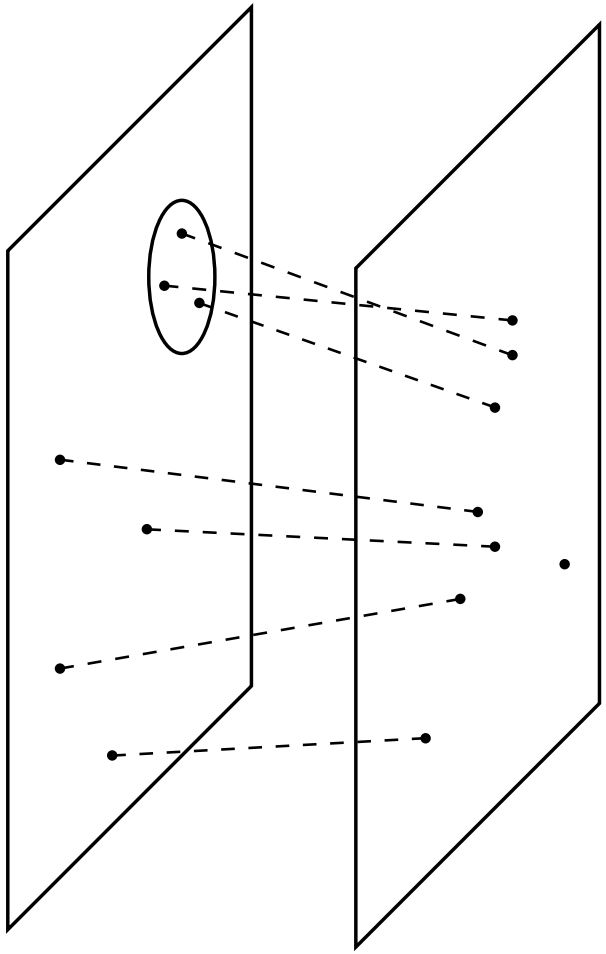

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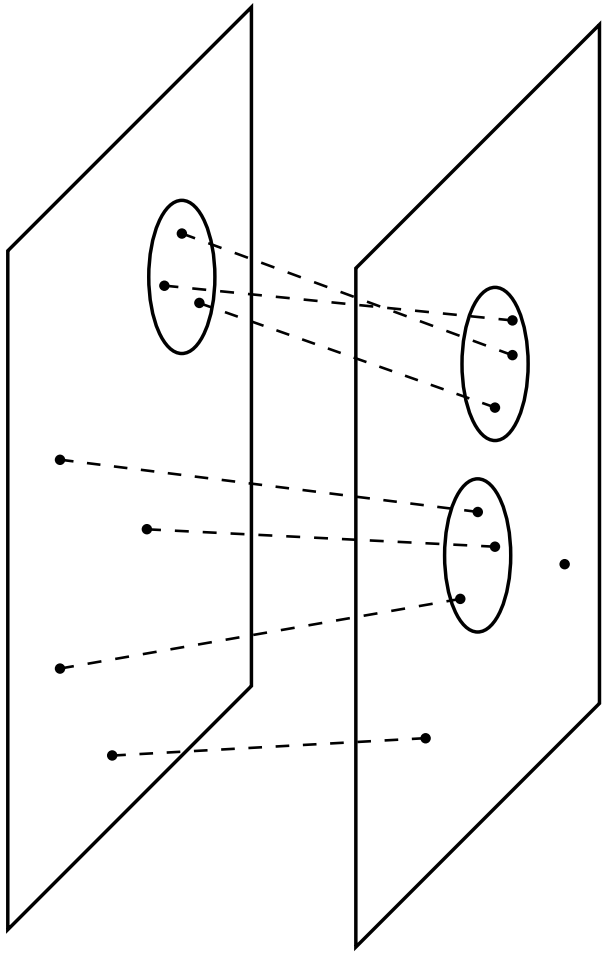

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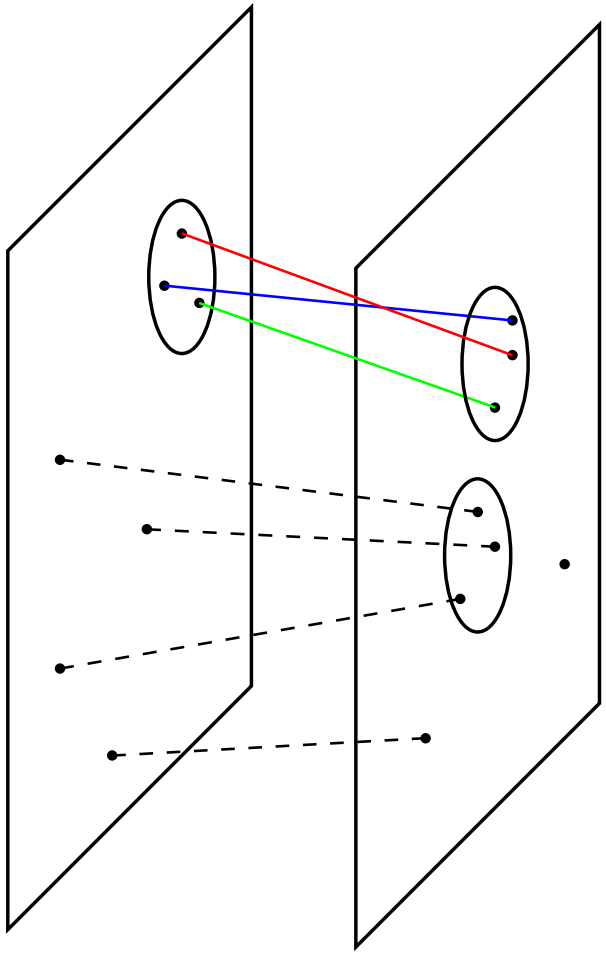

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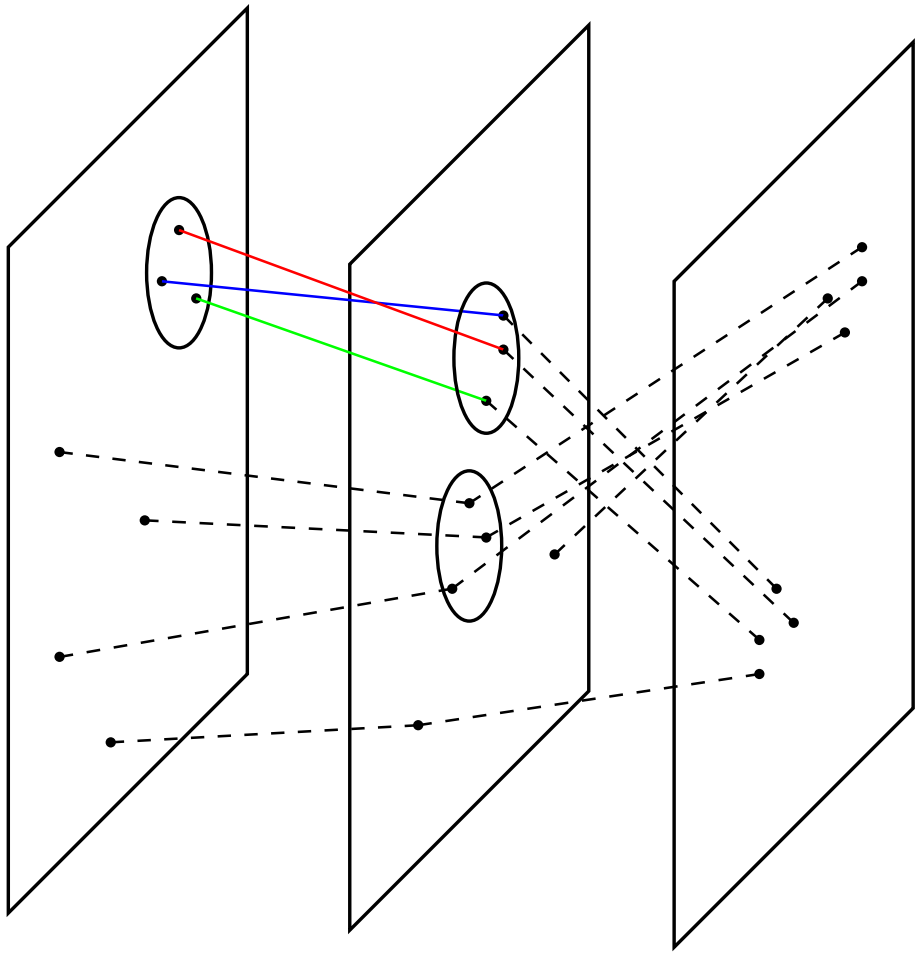
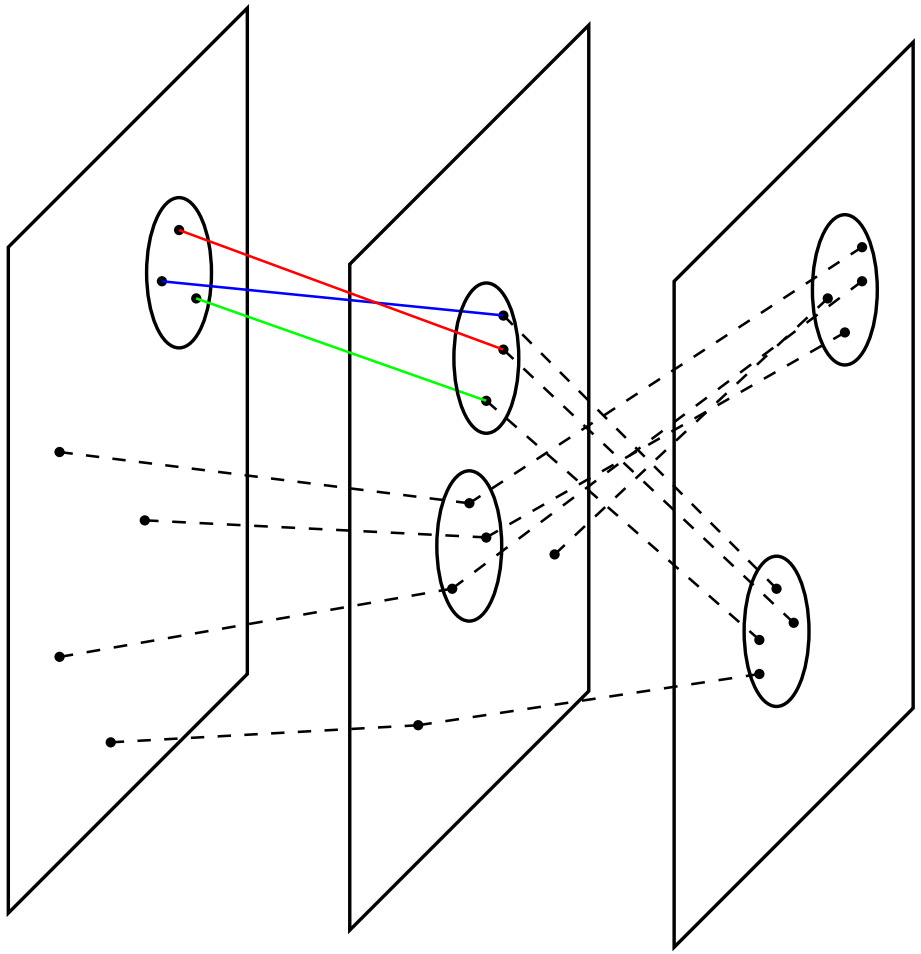


BFE algorithm (Vieira et al, 2009)



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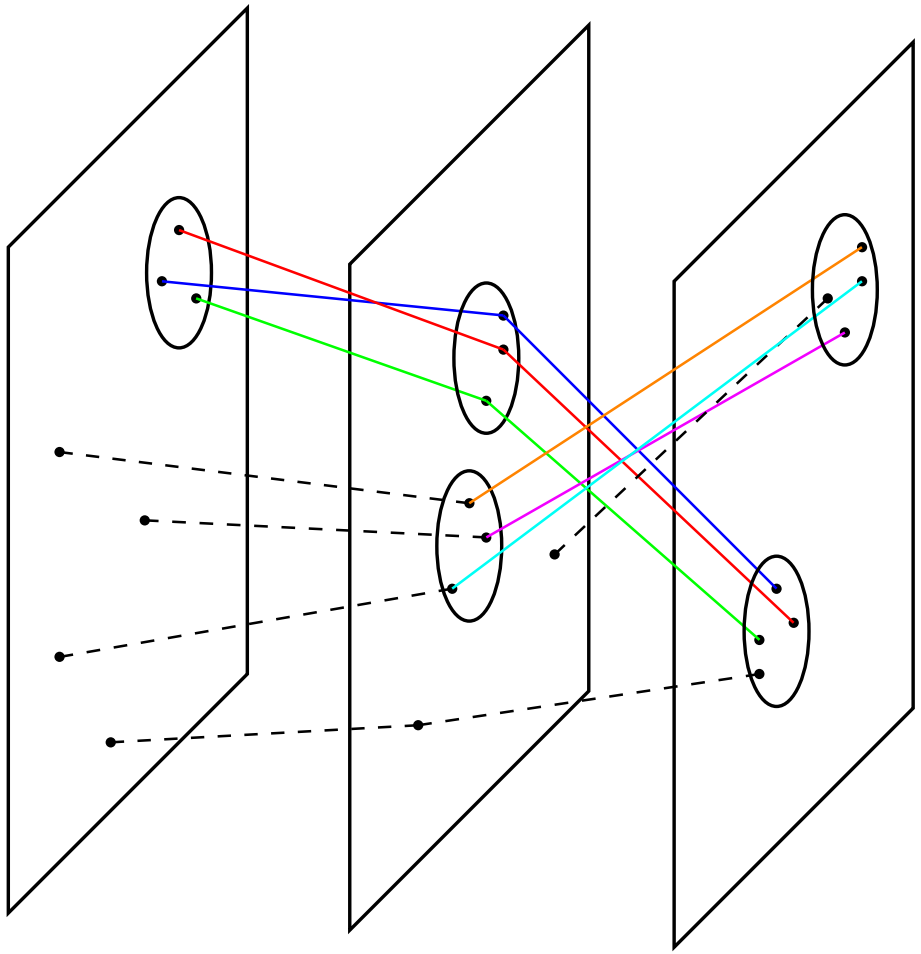

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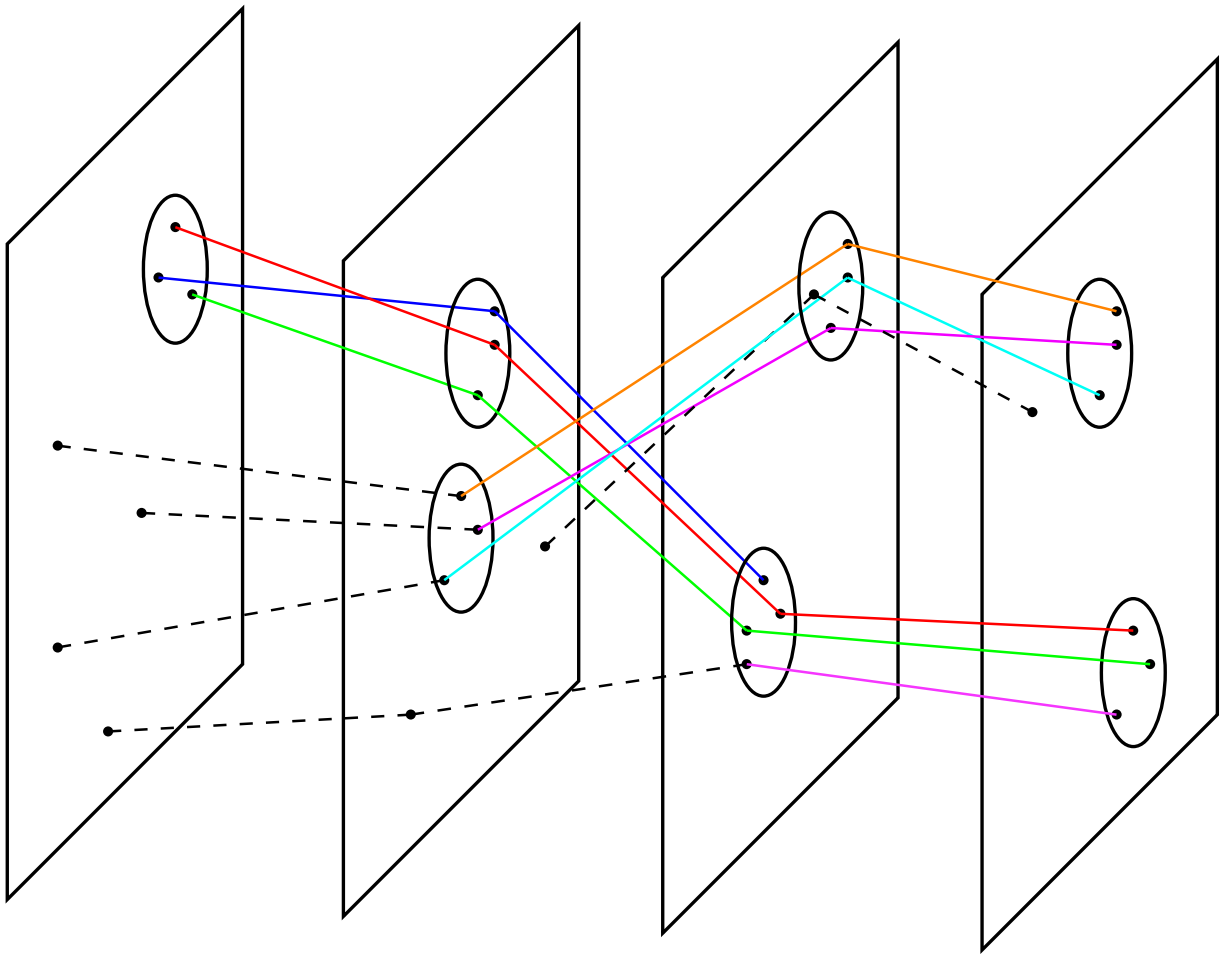


Motivation

Why is important of focus on flocks and finding disks???

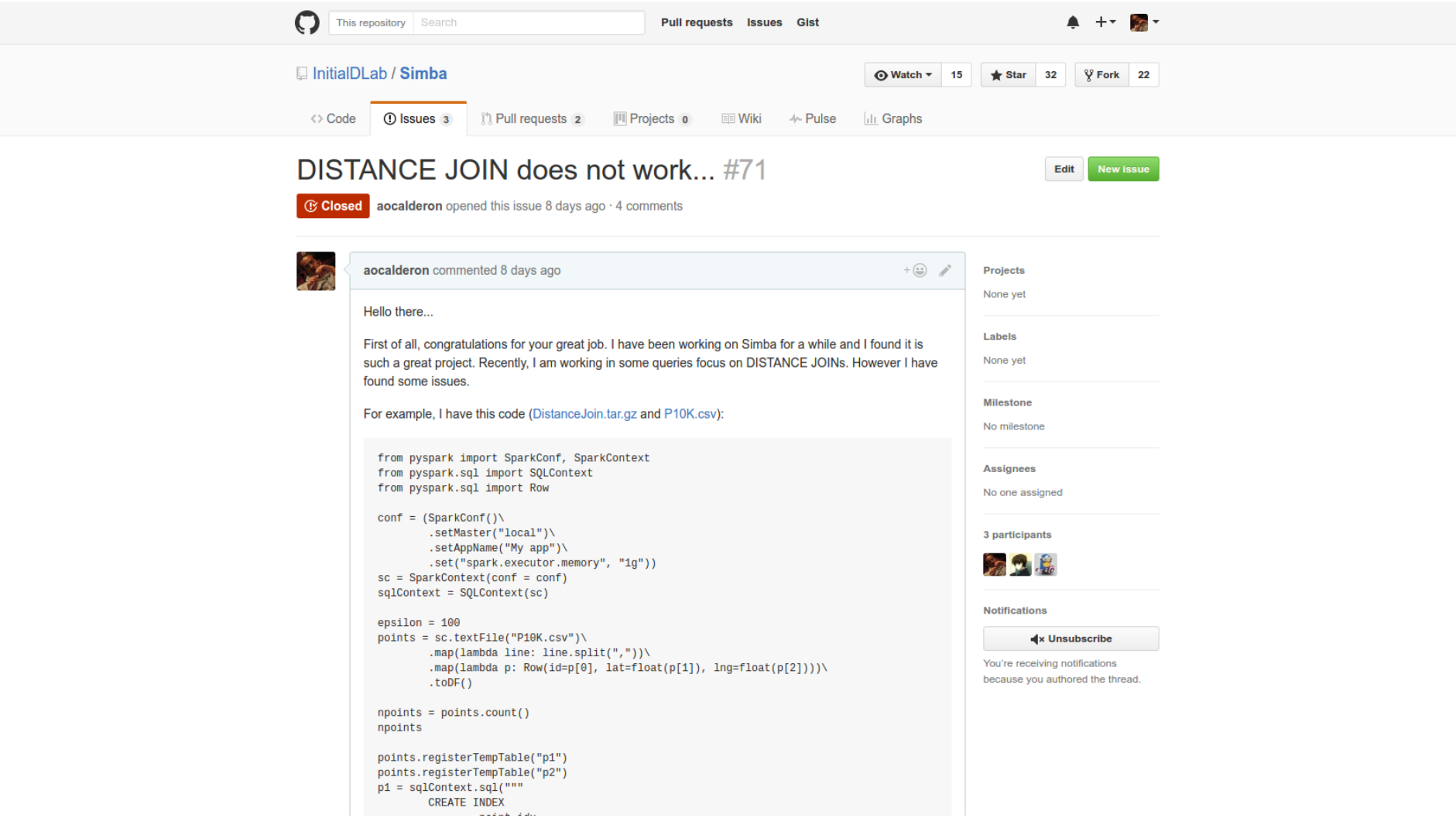
- Why are moving flock patterns important?
  - They capture the collective behavior of trajectories as groups.
- Why is the finding of disks important?
  - It is the base of the algorithm.
  - It has a high complexity ($\mathcal{O}(2n^2)$).
  - It is no trivial, disks can be at any location.

Outline

Demo

- Demo time:
  - `http://tinyurl.com/jl55849`.

Bug report



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DISTANCE JOIN does not work... #71

Edit New issue

Closed aocalderon opened this issue 8 days ago · 4 comments

aocalderon commented 8 days ago

Hello there...

First of all, congratulations for your great job. I have been working on Simba for a while and I found it is such a great project. Recently, I am working in some queries focus on DISTANCE JOINs. However I have found some issues.

For example, I have this code (DistanceJoin.tar.gz and P10K.csv):

```
from pyspark import SparkConf, SparkContext
from pyspark.sql import SQLContext
from pyspark.sql import Row

conf = (SparkConf()\
        .setMaster("local")\
        .setAppName("My app")\
        .set("spark.executor.memory", "1g"))
sc = SparkContext(conf = conf)
sqlContext = SQLContext(sc)

epsilon = 100
points = sc.textFile("P10K.csv")\
        .map(lambda line: line.split(","))\
        .map(lambda p: Row(id=p[0], lat=float(p[1]), lng=float(p[2])))\
        .toDF()

npoints = points.count()
npoints

points.registerTempTable("p1")
points.registerTempTable("p2")
p1 = sqlContext.sql("""
        CREATE INDEX
```

Projects
None yet

Labels
None yet

Milestone
No milestone

Assignees
No one assigned

3 participants

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https://github.com/InitialDLab/Simba/issues/71

Outline

Dataset

- **Beijing** from Geolife project[1].
  - 182 users in a period of over three years (from April 2007 to August 2012).
  - 17,621 trajectories.
  - ≈18 million points (no duplicates).

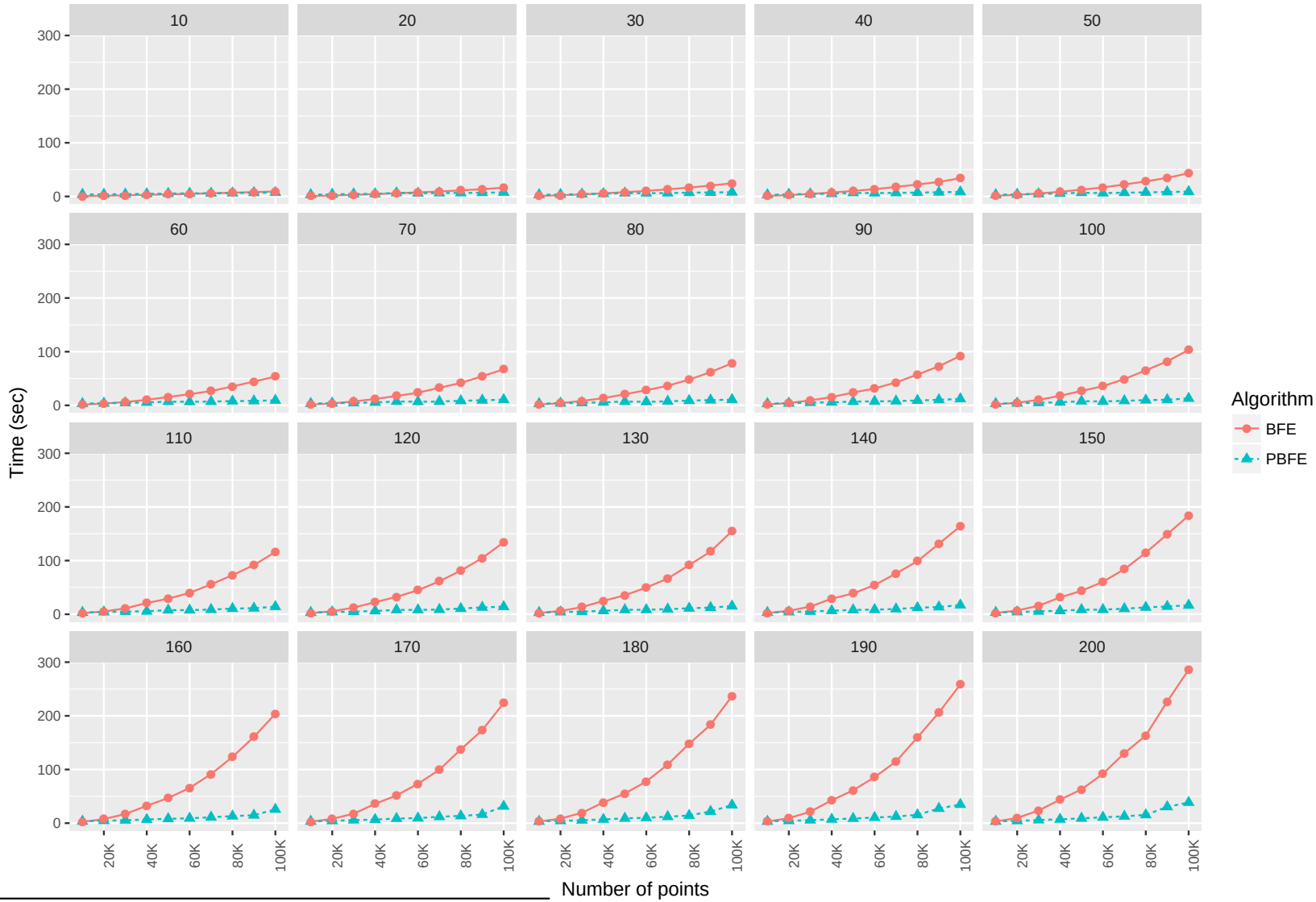
[1] http://tinyurl.com/j7t2cao

Setup

- Single-node.
- Processor: 4-core Intel(R) Core(TM) i5-2400S CPU @ 2.50GHz
- RAM: 8 GB.
- Ubuntu 16.04 LTS, Simba/Spark 1.6.0.

Beijing [N = 10K - 100K; ε = 10 - 200 (mts)]

Execution time by ε (radius of disk in mts) in Beijing dataset.



http://tinyurl.com/js6us8g

Dataset

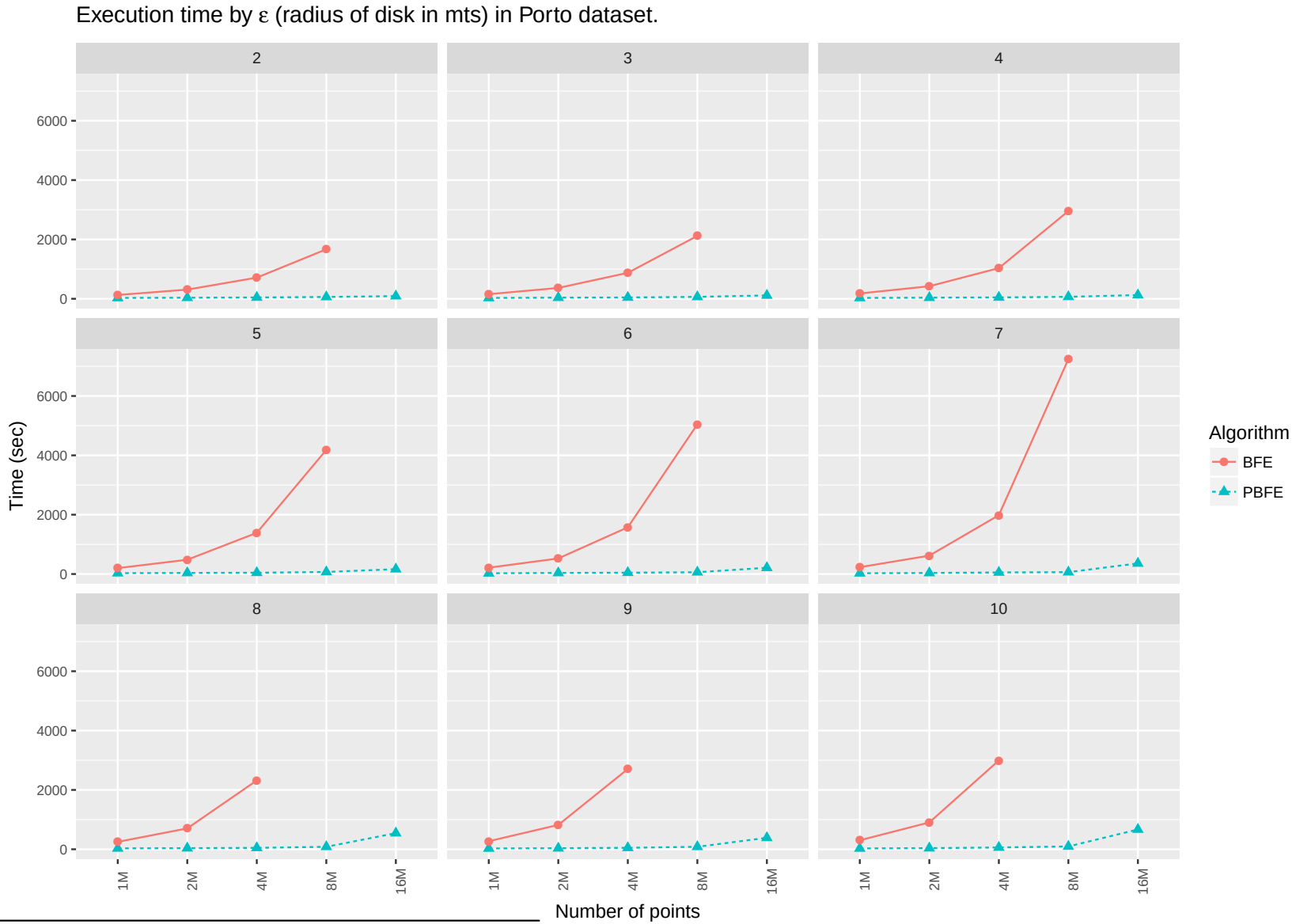
- **Porto** from ECML/PKDD 15 Taxi Trajectory Prediction Challenge[2].
  - A complete year (from 01/07/2013 to 30/06/2014).
  - Trajectories for all the 442 taxis running in the city of Porto, in Portugal.
  - ≈17.7 million points (no duplicates).

[2] http://tinyurl.com/zzbtlt9

Setup

- 4-node cluster at DBLab.
- Processors: 8-core Intel(R) Xeon(R) CPU E3-1230 V2 @ 3.30GHz
- RAM: 15.5 GB.
- Centos 6.8, Simba/Spark 1.6.0.

Porto [N = 1M - 16M; ε = 2 - 10 (mts)]



http://tinyurl.com/j9u9c7h

Outline

Conclusions

Cooming soon...

Thank you!!!

Do you have any question?