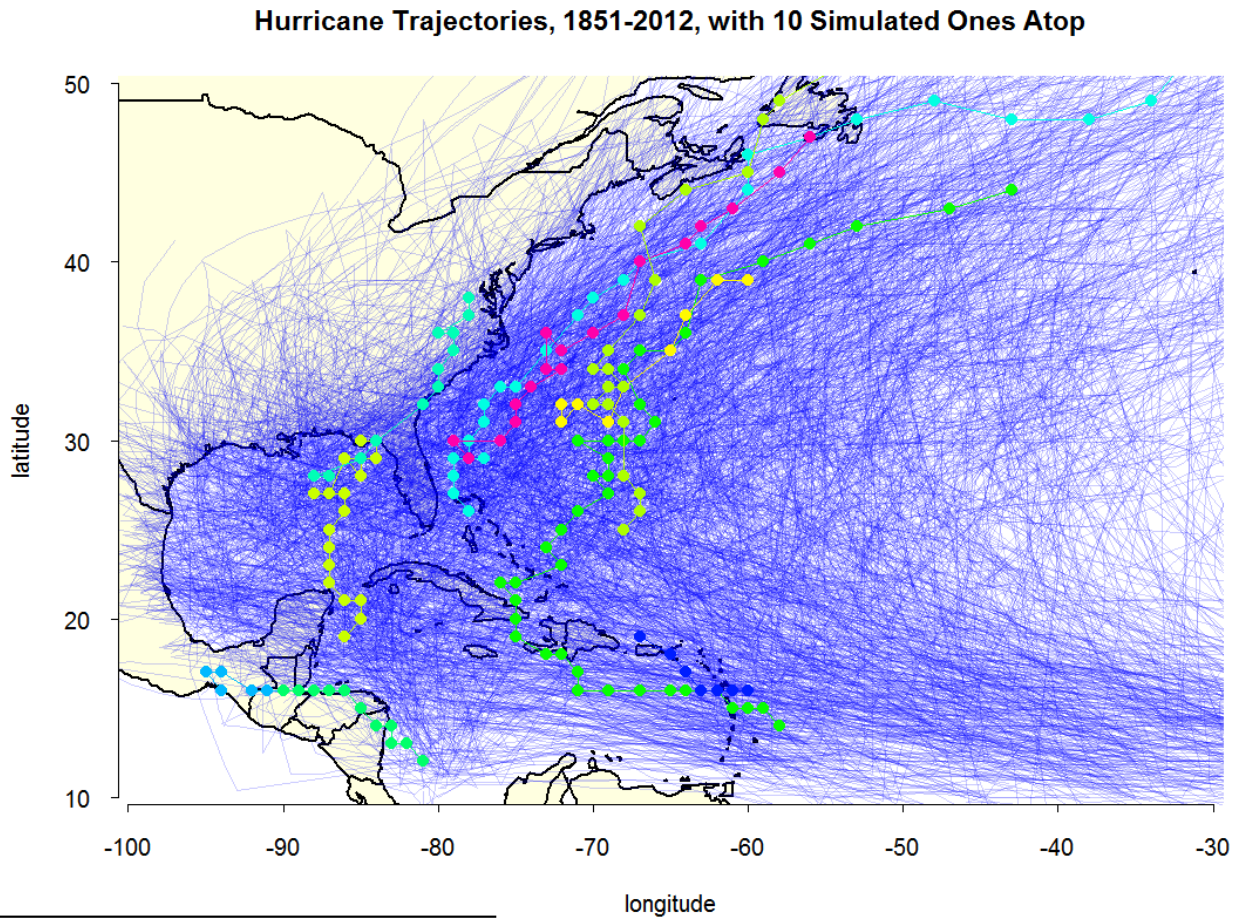
Towards Parallel Detection of Moving Flock Patterns in Large Spatiotemporal Datasets

Andres Calderon

December 1, 2016

Trajectory Datasets

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



http://tinyurl.com/h4mbvxz

Applications

kaggle Host Competitions Datasets Kernels Jobs Community ▾ Sign up Login

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

Home
- Data
- Make a submission

Information
- Description
- Evaluation
- Rules
- Prizes
- Timeline

Forum

Kernels
- New Script
- New Notebook

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

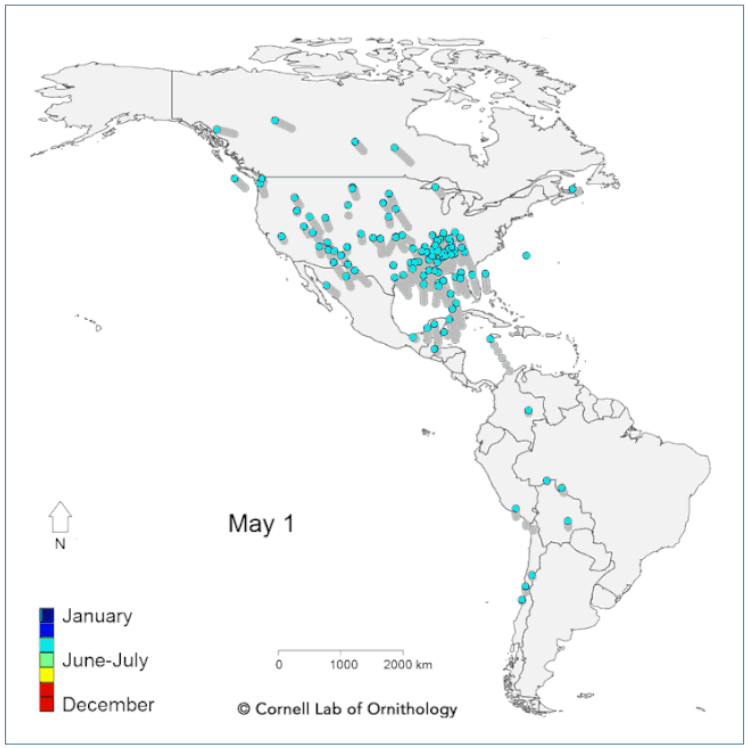
SATURDAY, JANUARY 23, 2016

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

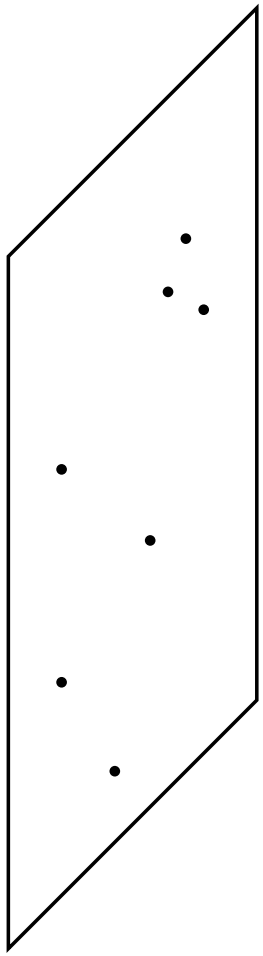
Outline

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)



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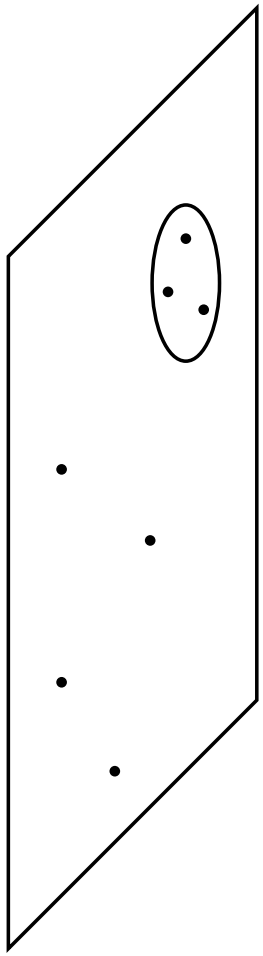

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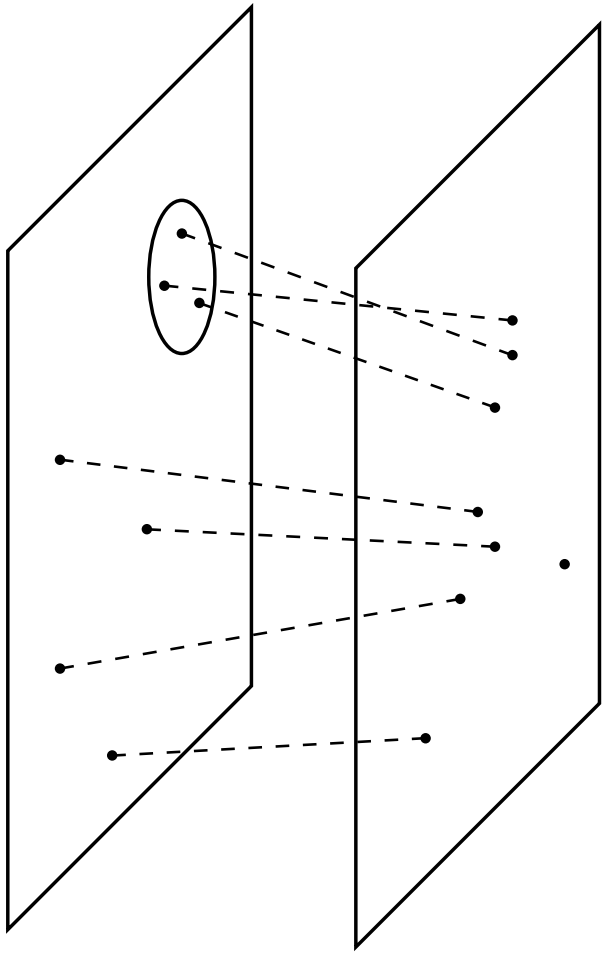

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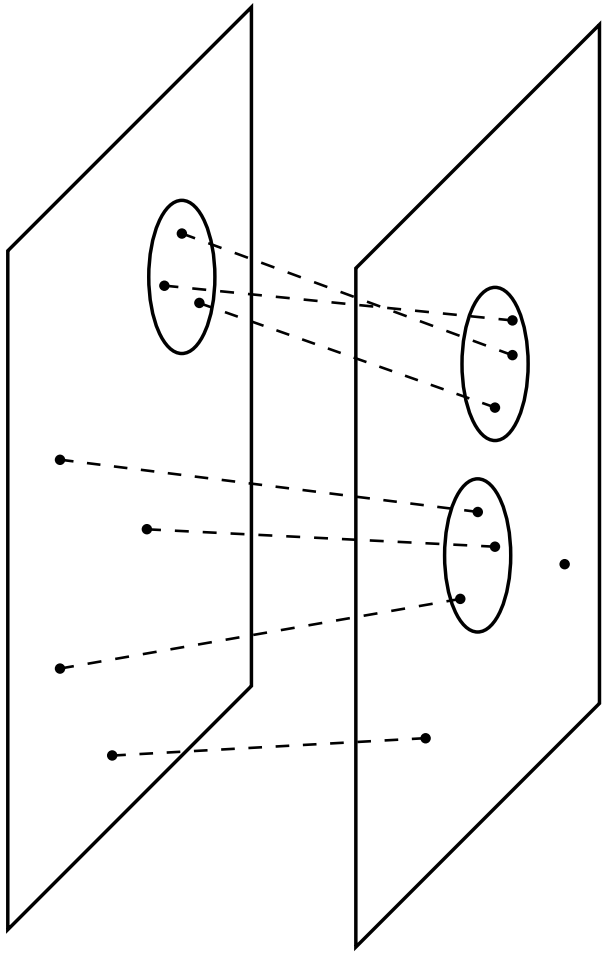

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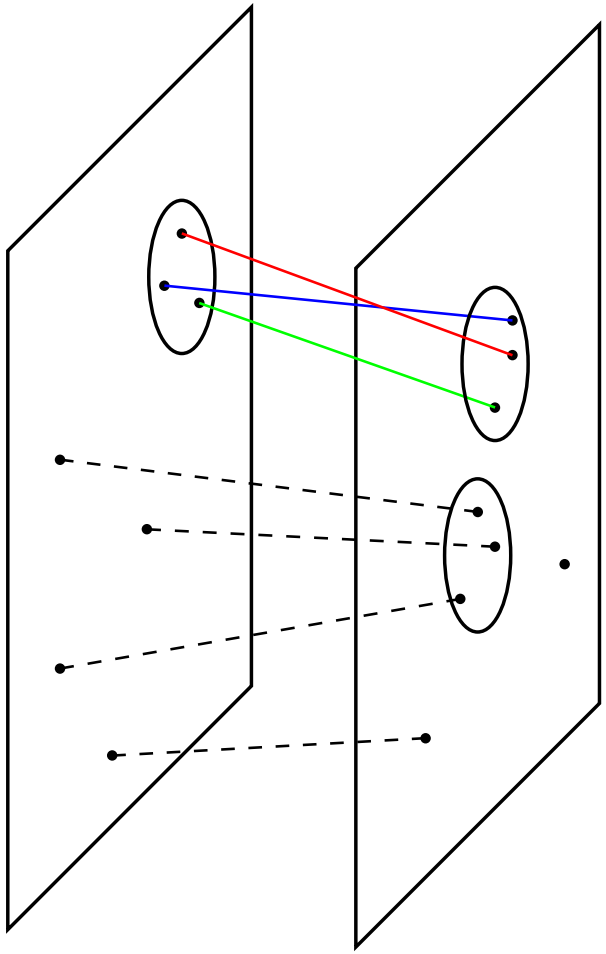

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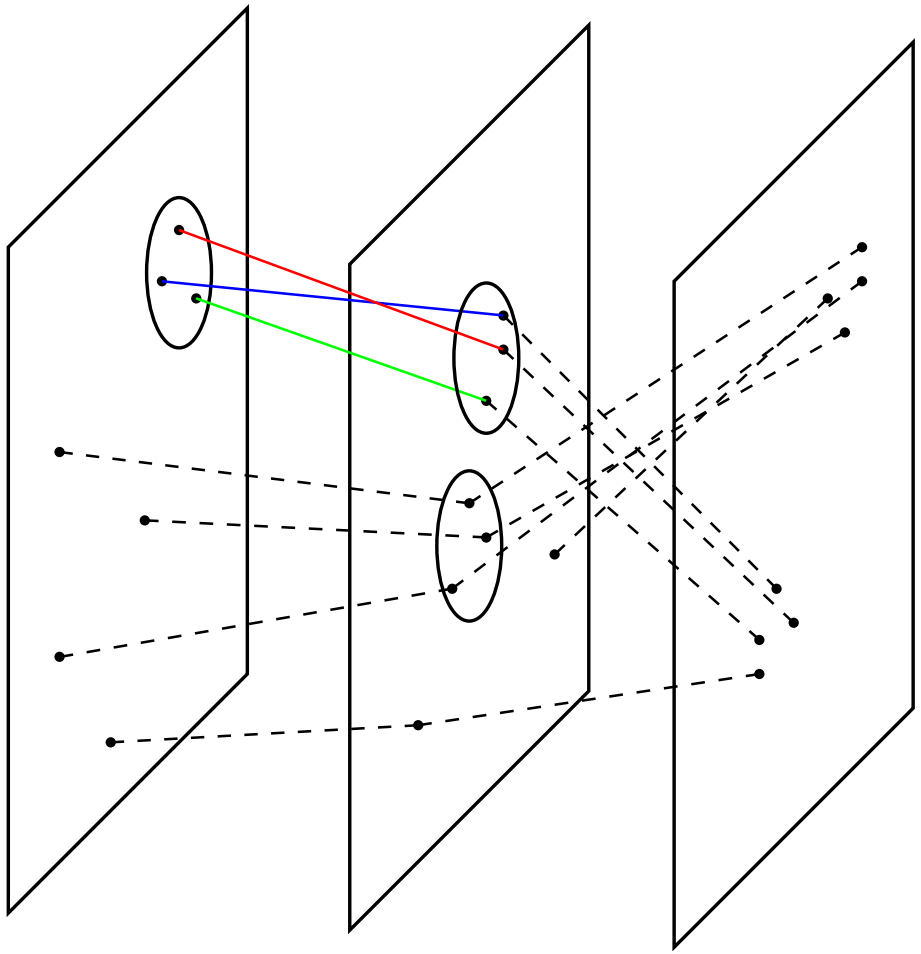

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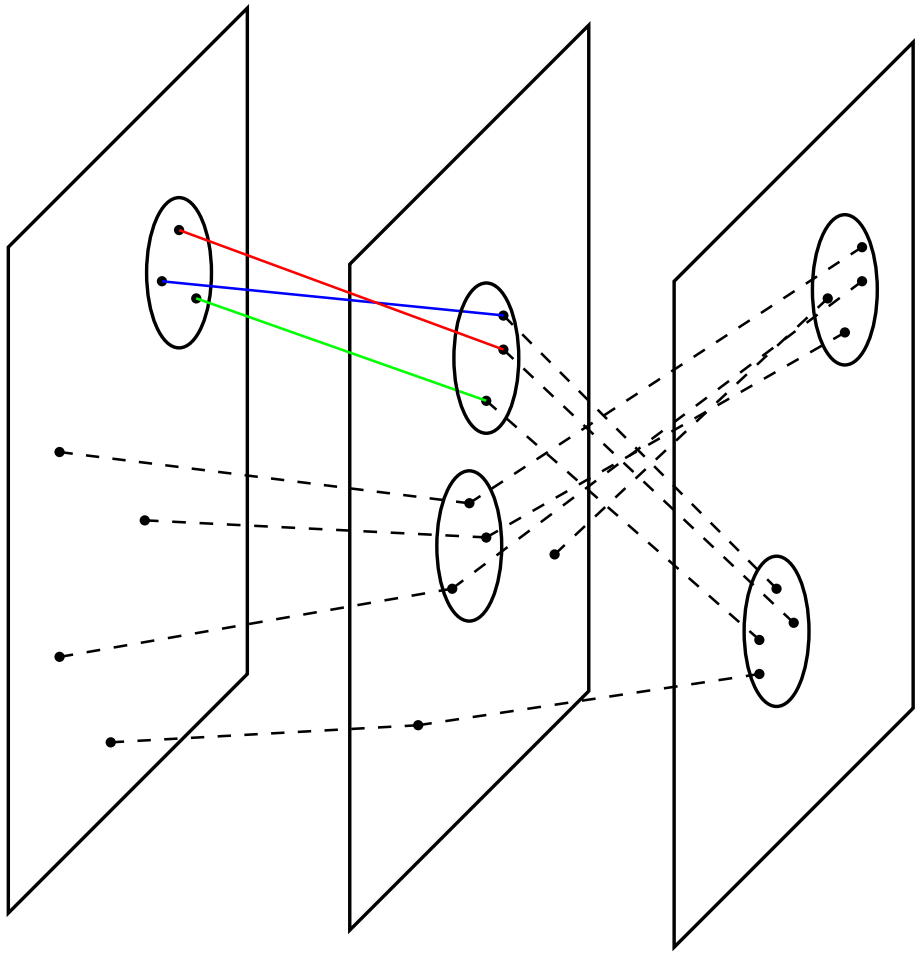

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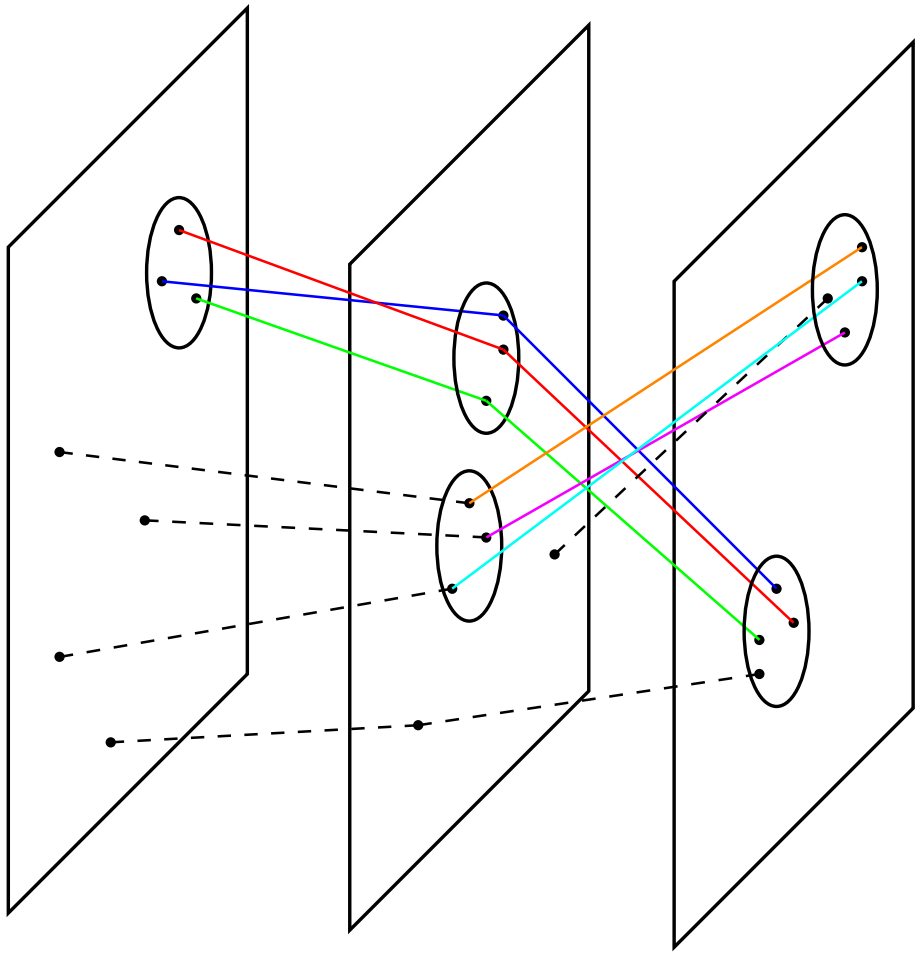

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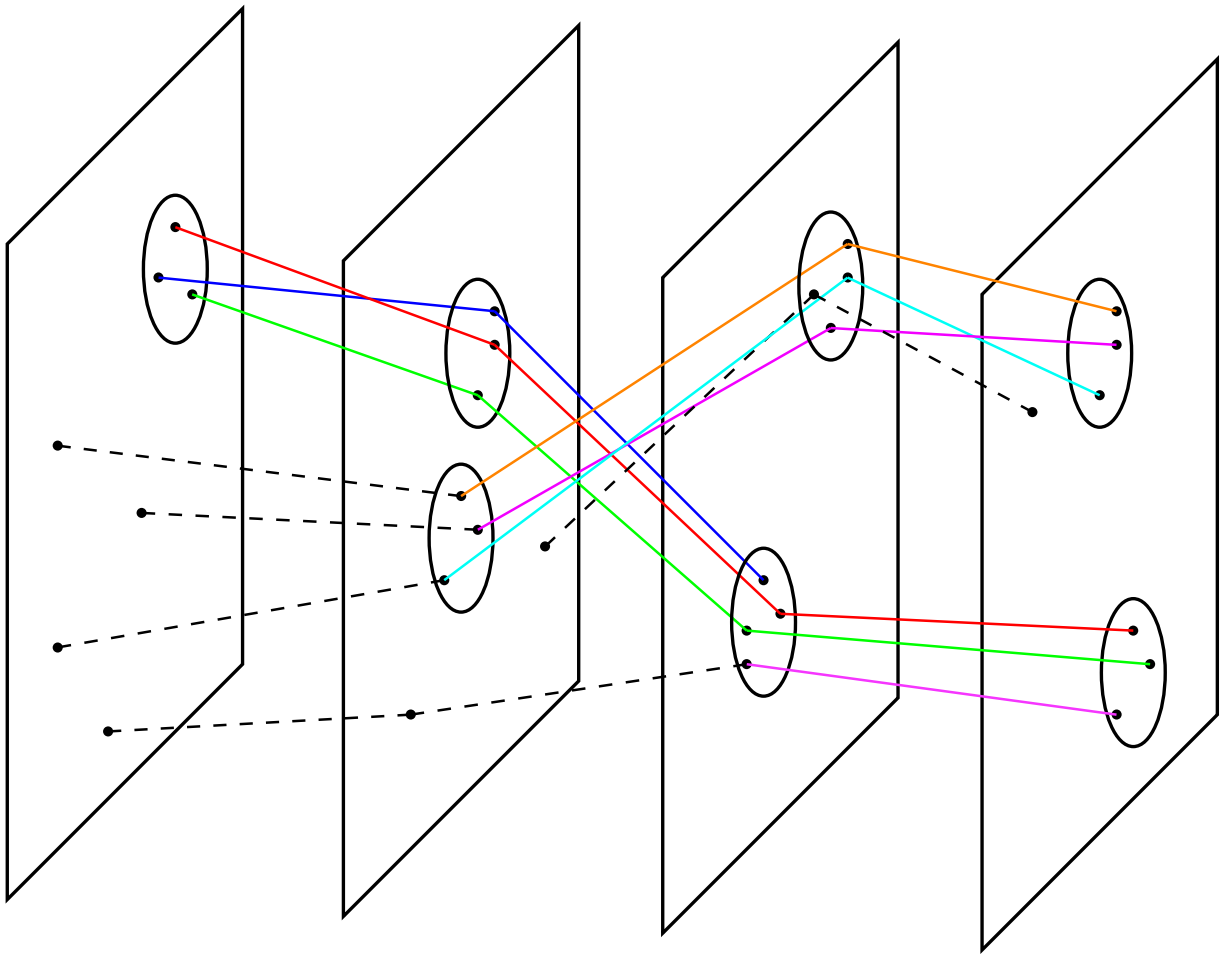

Why am I doing this???

- 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 but 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`.

Outline

Setup

- 10 nodes cluster
- Processors: 6-core Intel Xeon E5 (1.6 to 2.0 GHz)
- RAM: 20 to 56 GB.
- Ubuntu 14.04 LTS, Hadoop 2.4.1, Spark 1.3.0

Datasets

- OSM (OpenStreetMap)
  - 2.2 Billion records, 132GB.
  - Five fields: ID, a two-dimensional coordinate and two text information.
- GDEL (Global Data on Events, Language and Tone)
  - 75 Million records
  - Seven attributes: timestamp, three two-dimensional coordinates (start, end and action of the event).
- RC (Synthetic dataset)
  - 1 Million to 1 Billion records, 2 to 6 dimensions.
  - Clusters randomly generated using Gaussian distributions.

Outline

Range and kNN Operations (OSM)

Outline

Range Query Performance (GDELT)

Outline

Join Operations Performance (RC)

Outline

Conclusions

Cooming soon...

Thank you!!!

Do you have any question?