Strategical analysis of trajectories in a competitive video game

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Outline

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Motivations

- With the new technologies, the trajectories are more studied.
- Classical sport is hard to study.
- New kind of sport is growing : the electronic sport.
- Research is easier on e-sport : lots of data available.

What is e-sport ?

- E-sport is a competition between players through a video game.
- Two teams are facing each other, like in a classical sport.
- Tournaments where the winner gains a reward.

A growing phenomenon

The reward of the greatest DotA 2 tournament, a prize pool of more than 10 millions dollars.

Other applications for trajectory studies

- Classical sport.
- Consumer behavior analysis.
- Ships meeting.

Outline

DotA 2 : Defense of the Ancients

- The studied game : DotA 2.
- Competitive game in 5 versus 5.
- Pushing-game in the fashion of rugby or american football.
- Goal : destroy the enemy base.

Purpose

- Data mining approach : no additional knowledge.
- Analyze trajectories and find knowledge.
- Find specific strategies only in the players trajectories ?
- Provide a tool for the players, coachs, casters.

General aim

- Transform trajectories into sequences.
- Mine these sequences.
- Strategies are frequent patterns.

Outline

State of the art

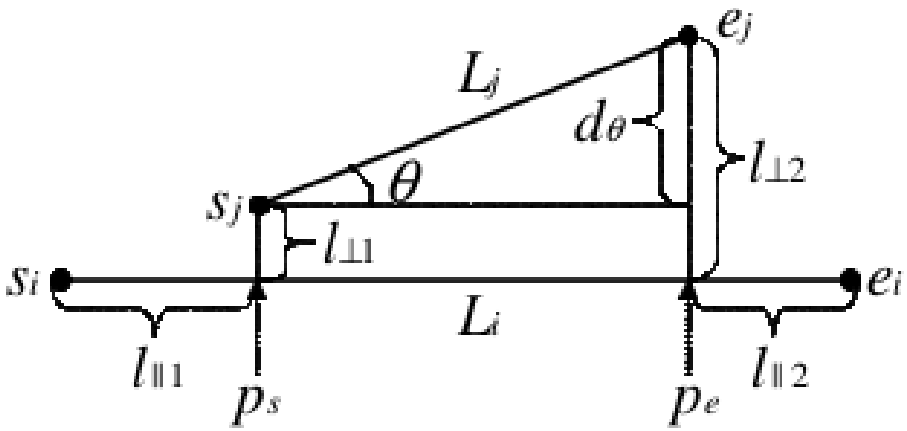
- TRACLUS [Lee and *al*. 2007]
- Following [Li and *al*. 2013]
- Attraction and Avoidance [Li and *al*. 2013]
- Flocking [Benckert and *al*. 2008]

TRACLUS

TRACLUS : from trajectories to sequences.

- Compression of the trajectories.
- Clustering of segments.
- Representative trajectory.

Distance between the segments



$$d_\perp = \frac{l_{\perp 1}^2 + l_{\perp 2}^2}{l_{\perp 1} + l_{\perp 2}}$$

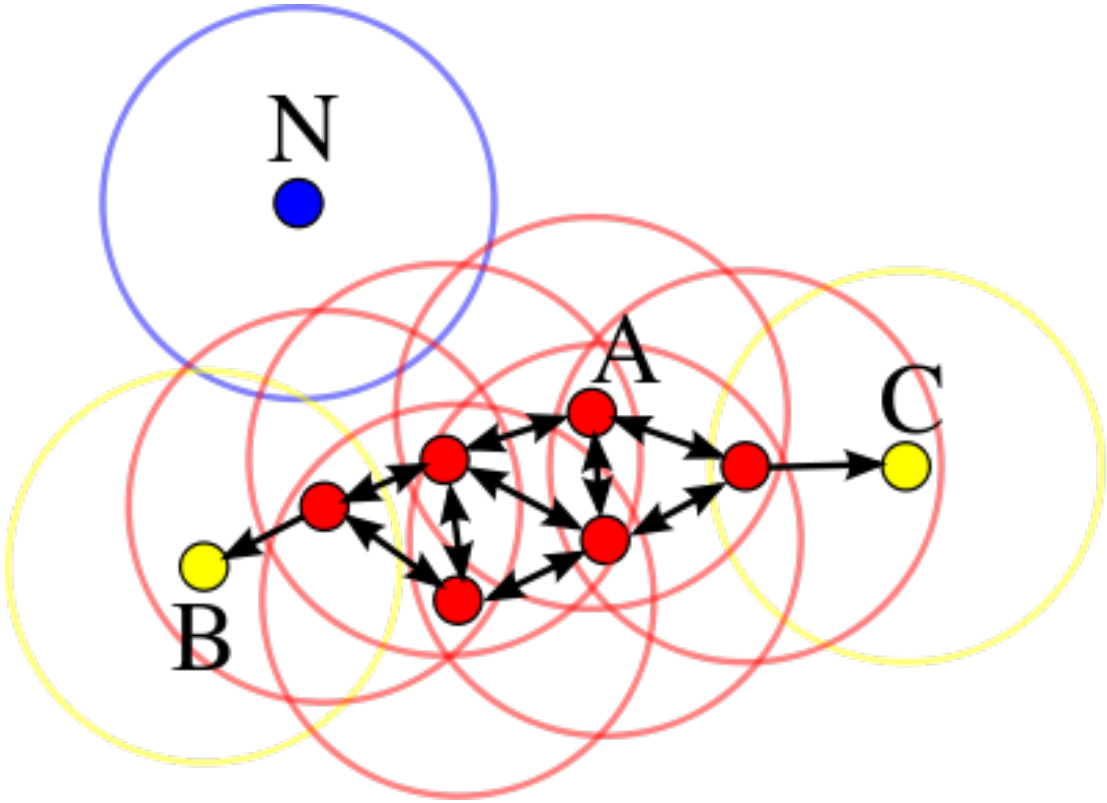
$$d_\parallel = \mathrm{MIN}(l_{\parallel 1}, l_{\parallel 2})$$

$$d_\theta = \|L_j\| \times \sin(\theta)$$

Problem : the distance is not symmetric.

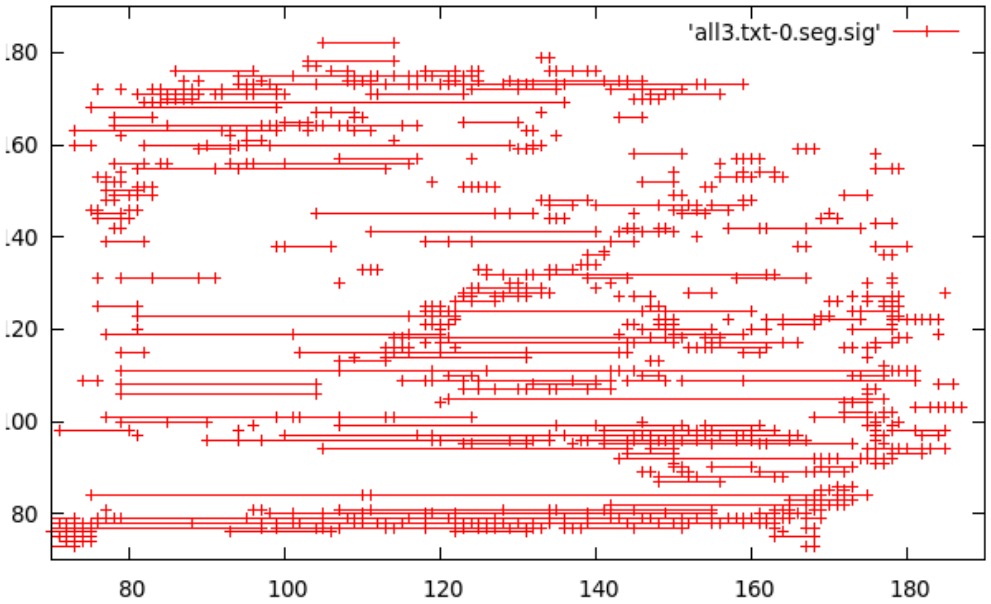
Clustering : DBSCAN

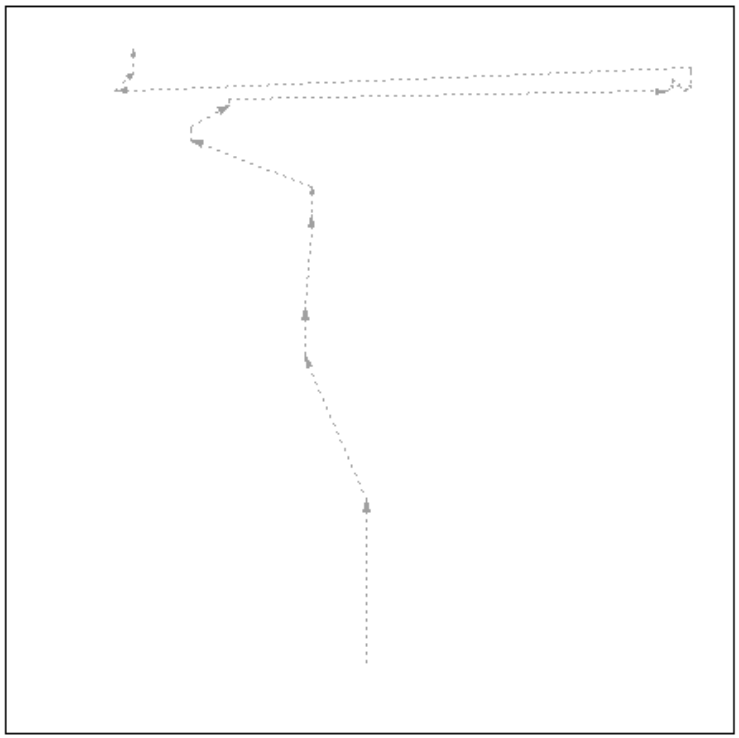
DBSCAN : a density algorithm.



Problem : extension of the neighborhood.

Representative trajectories



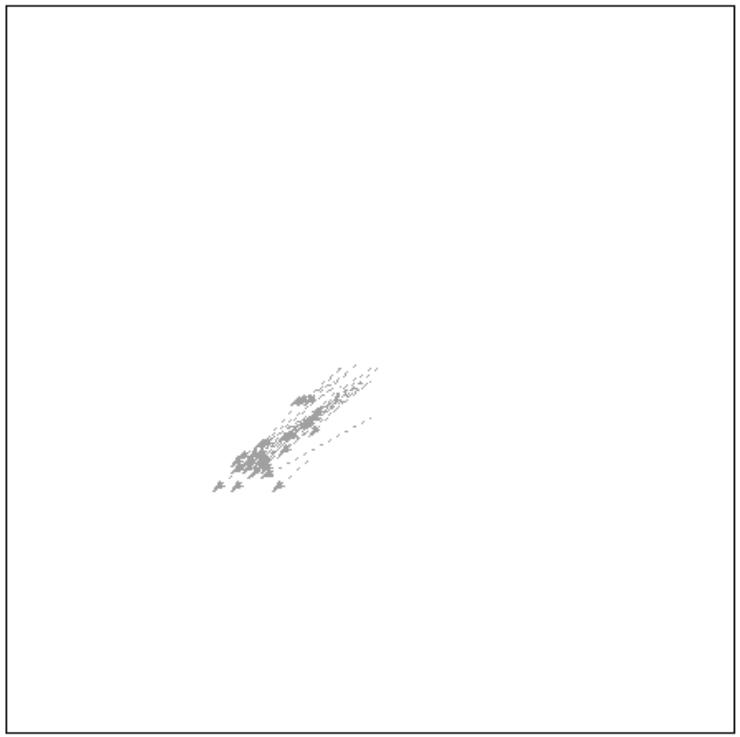


Representative trajectory don't fit with segments within cluster

Problems with this method

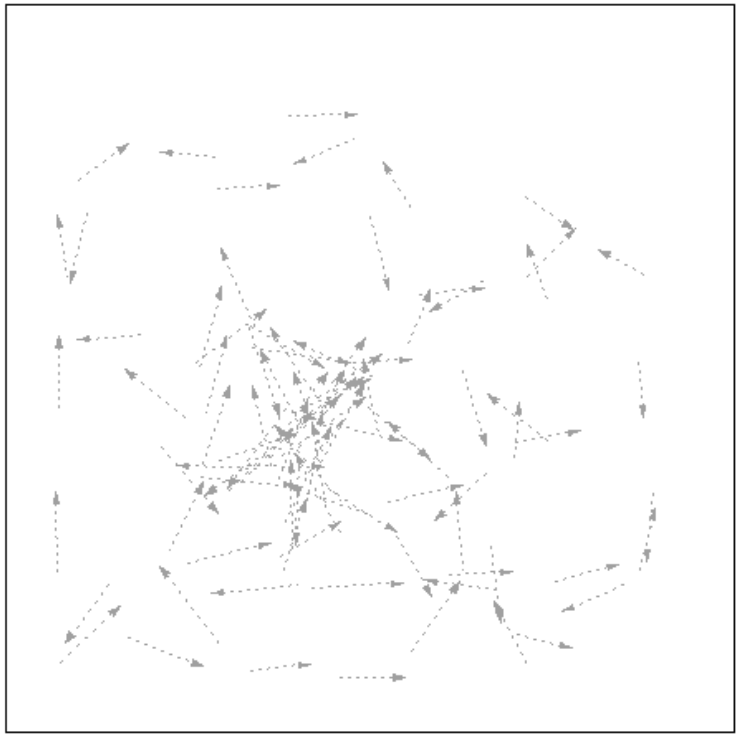
- Distance is not symmetric
- Neighborhood can easily extend
- All segments can be in the same cluster

Clustering : K-means



Clusters are better.

Coverage of the map with k-means



Results are good, but it's not enough.

A new method is needed

- The solution is good, but problem with the labeling.
- Several labels for the same movement.
- Central zone is fuzzy.

Outline

Attractive points

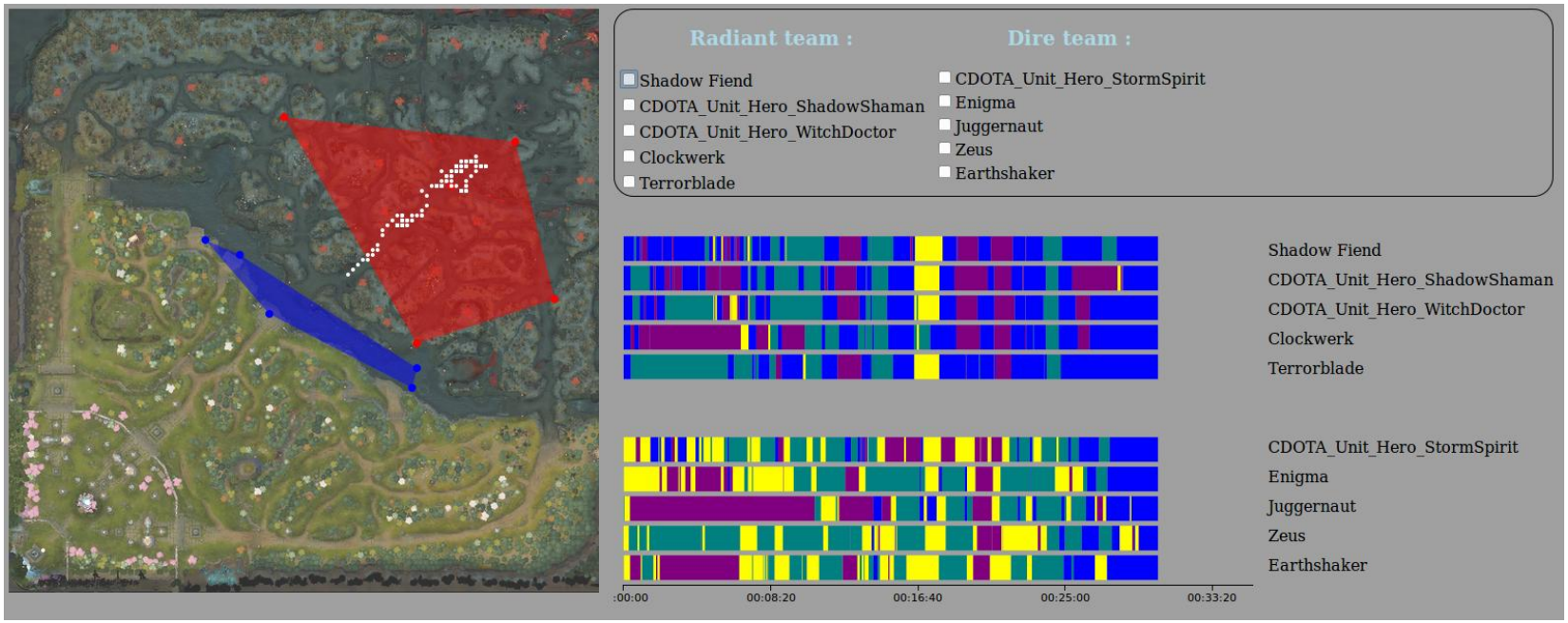
130 Attractive points

Trajectories are represented by segments between attractive points.

Next steps

- Transformation of trajectories into series of segments.
- Mining of the sequences.
- Show results on the interface.

Web interface



Outline

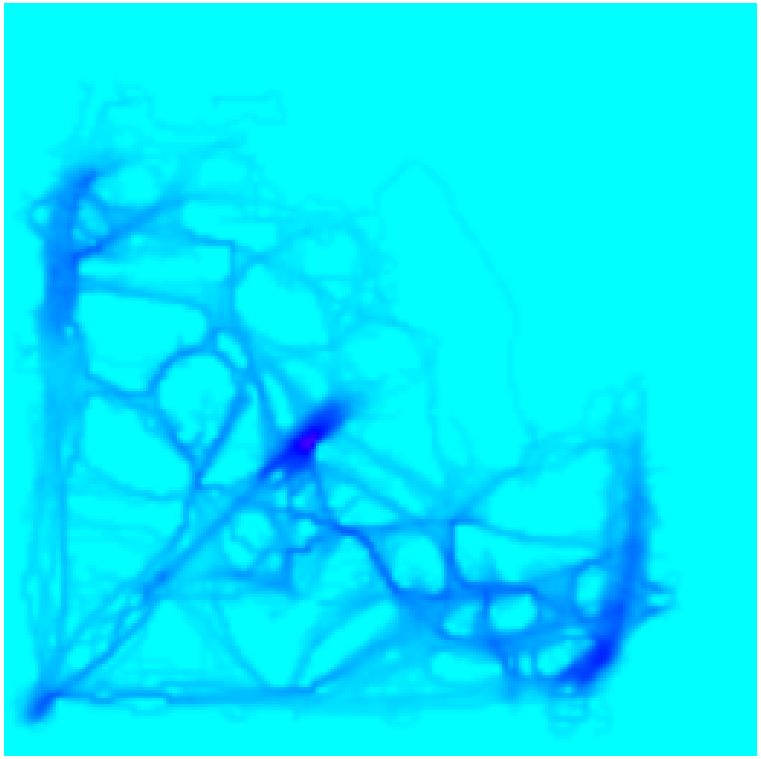
Conclusion

- Work in Progress.
- Results are encouraging.
- Sequences are easier to extract with attractive points.

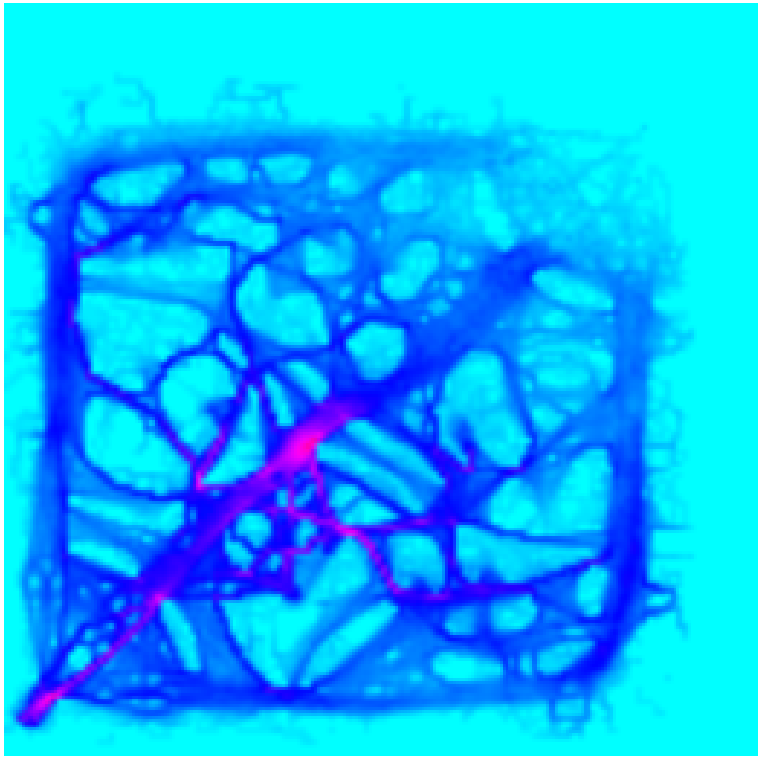
Further work

- Temporal evolution.
- Heat map.
- Adapt the attractive points with time.

Heat map



Before 20min



After 20min