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# Exploring Spatio-Temporal Patterns in Sport Movement Observations

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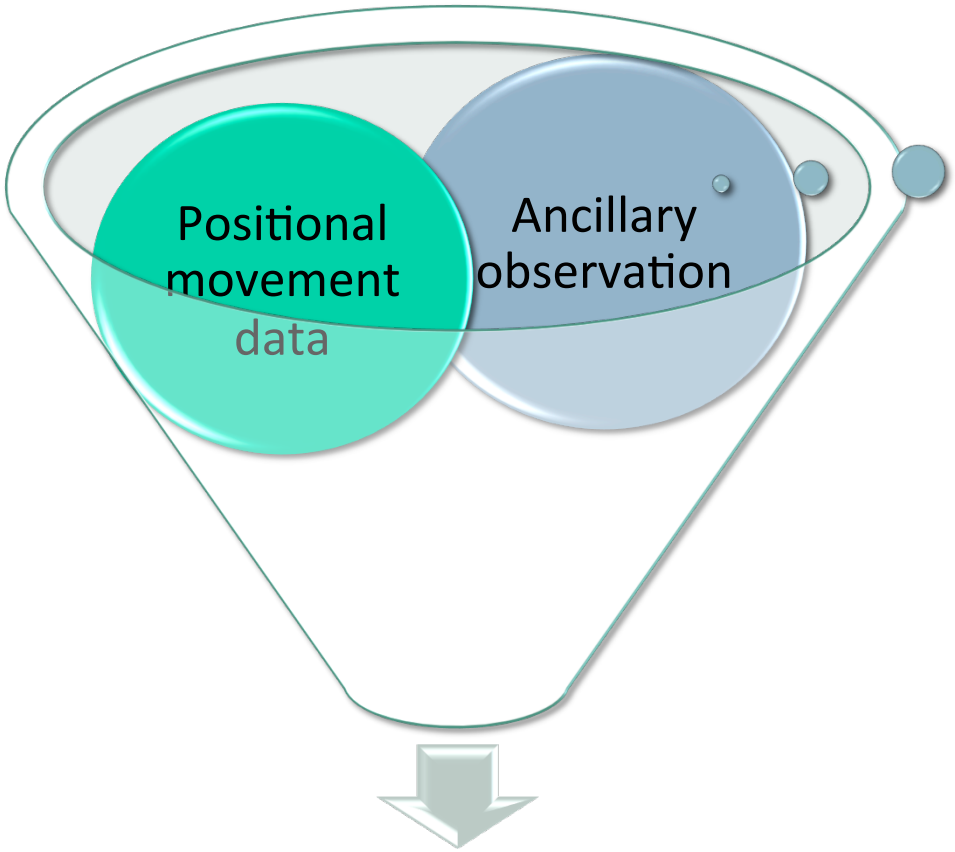
# Outline

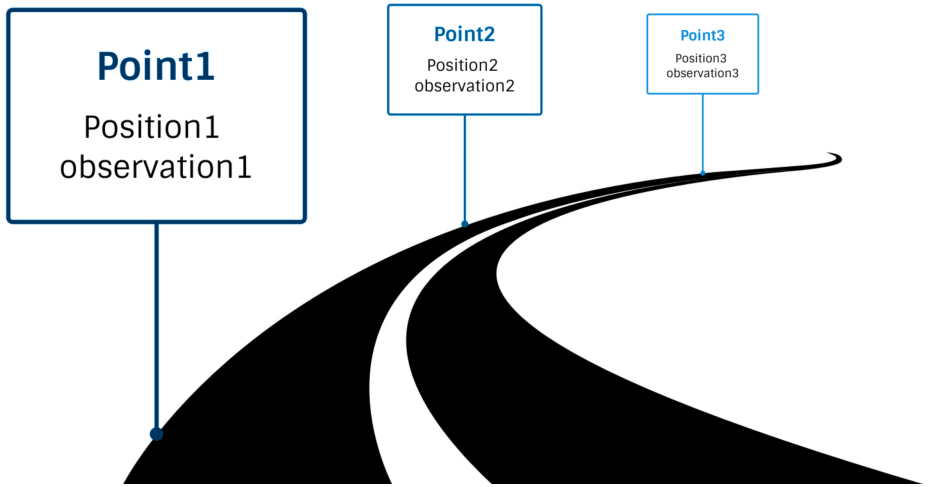
| | |
|---|---|
| Problem Definition | •Analysis of movement data to extract some movement characteristics and analysis of movement observations |
| Analyses of Sport Movement Data | •Movement pattern and similarities of athletes |
| Case Study | • Analyzing changes in different movement attributes in “orienteering” Sport |
| Conclusion and future work | • Discovering movement patterns by sophisticated computational analyses |

- Extracting meaningful movement information
- Discovering interesting movement patterns
- Exploring the dynamic behavior of moving objects

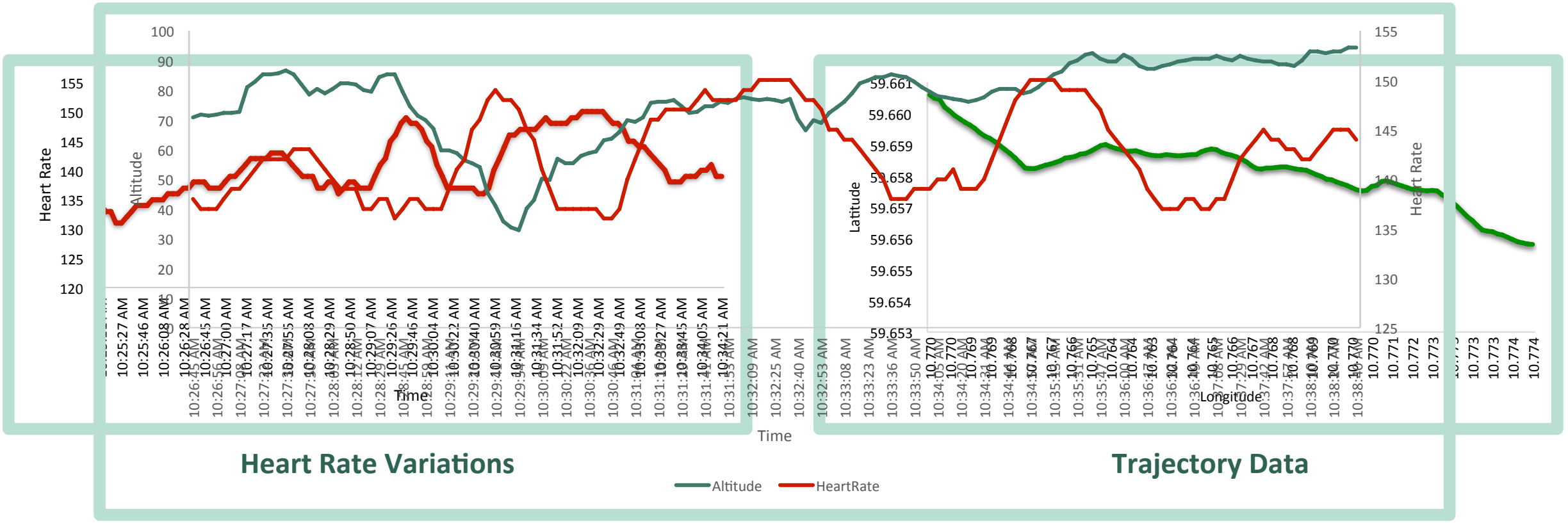
Require new exploratory tools and knowledge discovery techniques for analysis of movement observations




**Describing objects behavioral and cognitive proceeds**




Extracting the behavioral movement patterns by analyzing changes in different movement attributes




Spatial and ancillary Observation with Time

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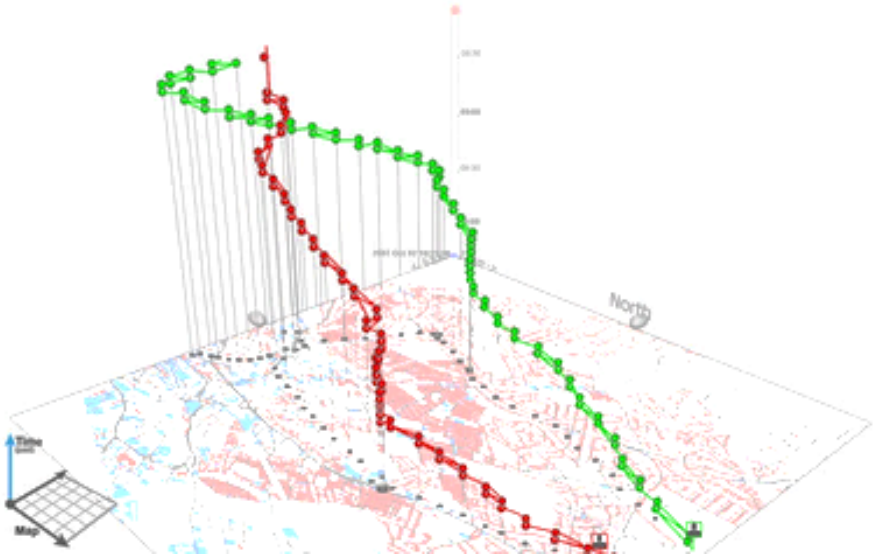
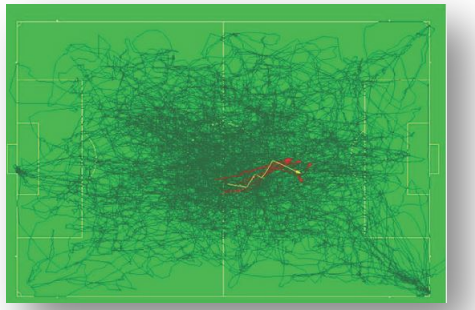
85 bpm
Fast
Slow
15°

❖Spatial and temporal data of a trajectory ➔ Representation, and concequently analysis, of geospatial lifelines.

| | |
|---|---|
| Dodge (2011) | Detecting movement similarities |
| Demsar (2015) | Reviewing some methods for analysis and visualization of trajectory data |



Gudmundsson and Wolle (2010) — Studying frequent movements of an individual football player and groups of players

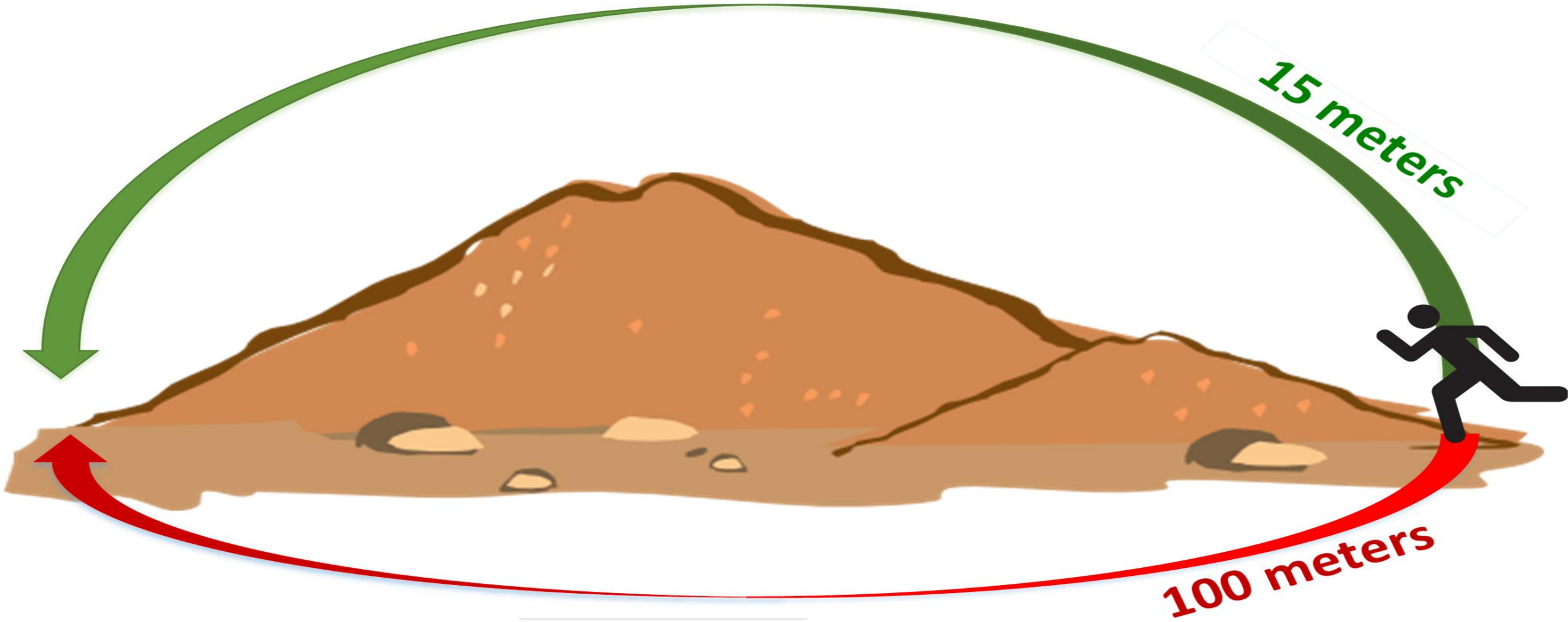


Taki and Hasegawa (2000)
Fujimura and Sugihara (2005)
Kang et al. (2006) — Extracting the players' dominant regions (the area where a player has priority over others)

**Focusing on spatial aspects of the movement to extract some movement characteristics**

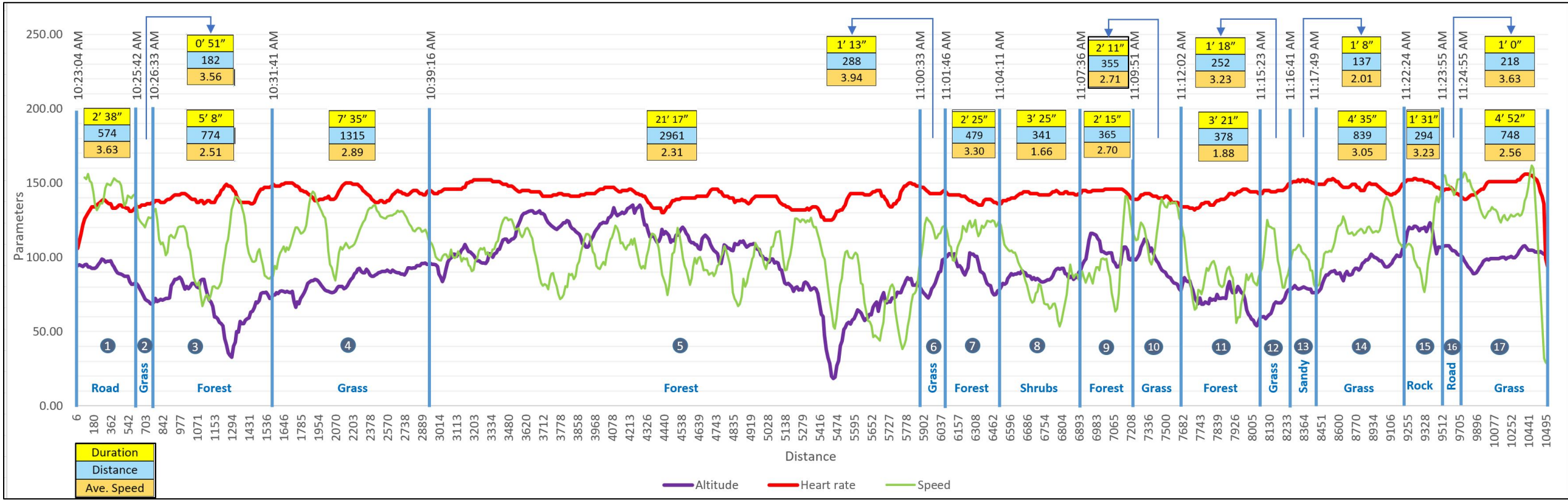
- Coupling Temporal and spatial data with field observations enable extraction of movement patterns.

| | |
|---|---|
| Hollman et al. (2007) | Examined the effect of age on gait velocity and stride-to-stride variability during normal and dual task walking conditions. |
| Bert-Losier et al. (2015 and 2014) | Exploring the effect of different situations on runners' biomechanics |


15 meters
100 meters

As

| Time | Distance (Meters) | Altitude (Meters) | HeartRate (BPM) | Speed (Normal) | Land Cover |
|---|---|---|---|---|---|
| 10:24:58 AM | 447.4815979 | 89.0593262 | 135 | 149.1291807 | road |
| 10:25:03 AM | 467.3476257 | 88.5787354 | 135 | 133.6714482 | road |
| 10:25:08 AM | 484.8355408 | 88.0980225 | 134 | 106.1720784 | road |
| 10:25:11 AM | 492.7898865 | 87.1365967 | 134 | 128.2955777 | road |
| 10:25:16 AM | 509.4507446 | 87.1365967 | 133 | 159.5234685 | road |
| 10:25:17 AM | 513.7437744 | 87.1365967 | 133 | 172.9914094 | road |
| 10:25:23 AM | 541.9883423 | 83.7719727 | 131 | 143.6176297 | road |
| 10:25:27 AM | 557.2028198 | 81.8493652 | 131 | 128.4179688 | road |
| 10:25:32 AM | 573.8825073 | 81.8493652 | 132 | 116.3772583 | road |
| 10:25:36 AM | 585.7443237 | 82.3300781 | 133 | 133.1304422 | road |
| 10:25:42 AM | 606.6299438 | 82.3300781 | 134 | 119.2292405 | grass |
| 10:25:46 AM | 618.8427734 | 80.8881836 | 134 | 118.2253523 | grass |
| 10:25:52 AM | 636.9766846 | 78.4847412 | 134 | 130.7715603 | grass |
| 10:25:58 AM | 657.4268188 | 76.5621338 | 135 | 119.3629715 | grass |
| 10:26:04 AM | 675.770752 | 74.1588135 | 135 | 108.1143949 | grass |
| 10:26:08 AM | 686.6156006 | 71.7554932 | 135 | 125.0437928 | grass |

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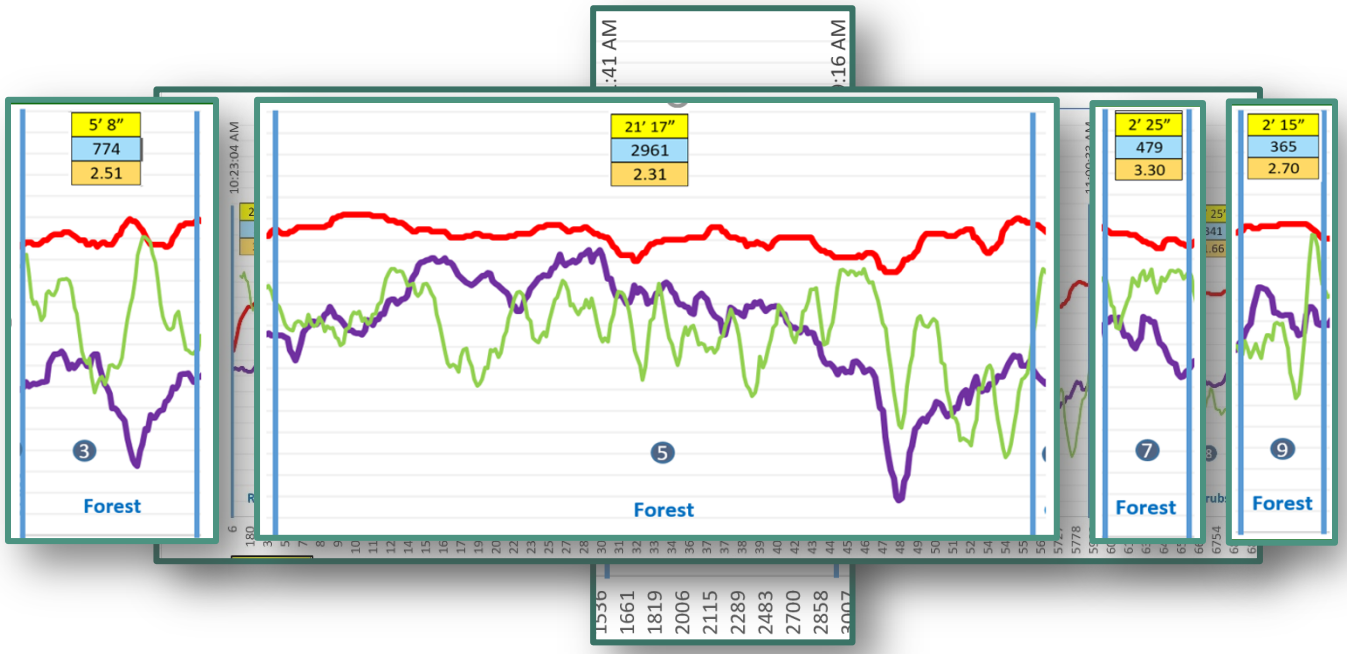
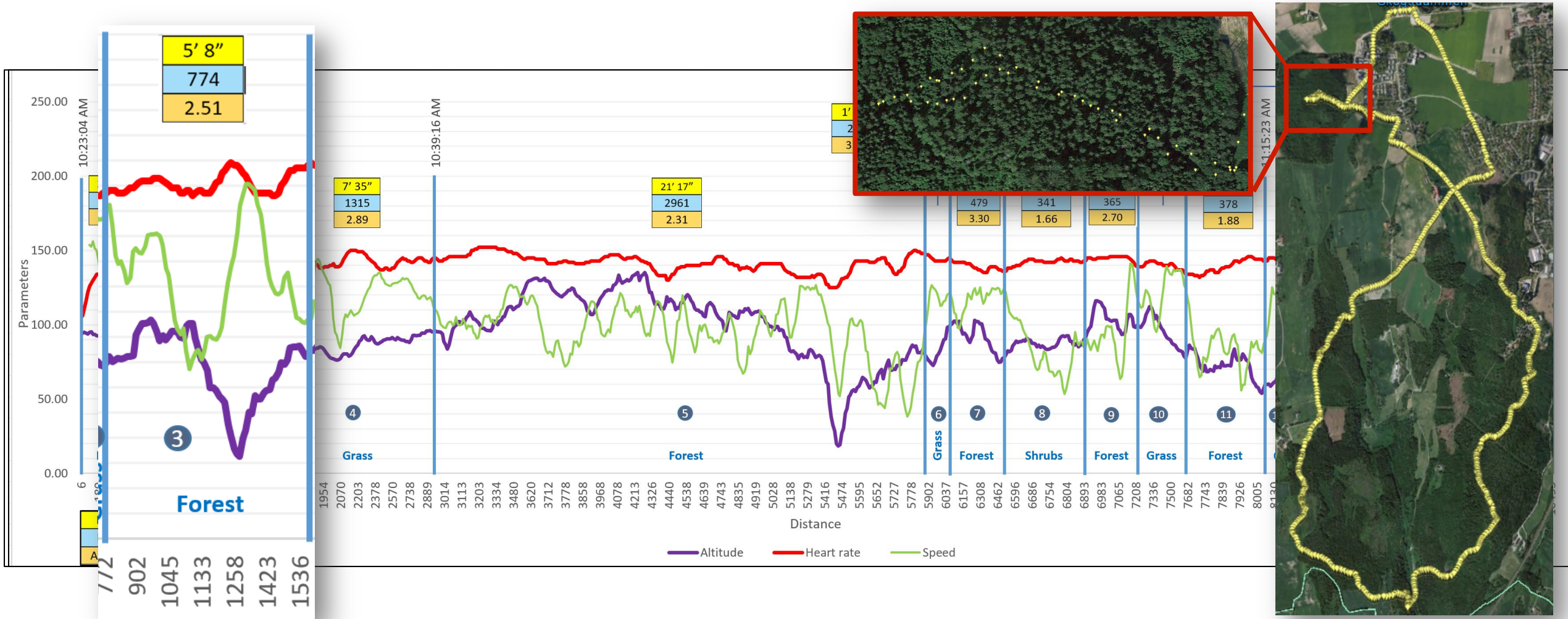
- Relation between parameters
  - The whole path
  - An individual section
  - Sections of the same type



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- Exploring movement observations to discover movement patterns
- Analyzing the orienteering movement observations
- More exploration of the patterns needs sophisticated computational analyses
- Investigating and exploring transformed movement data into time-dependent sequences

# Thank you for your attention!