

Sub-track-tion

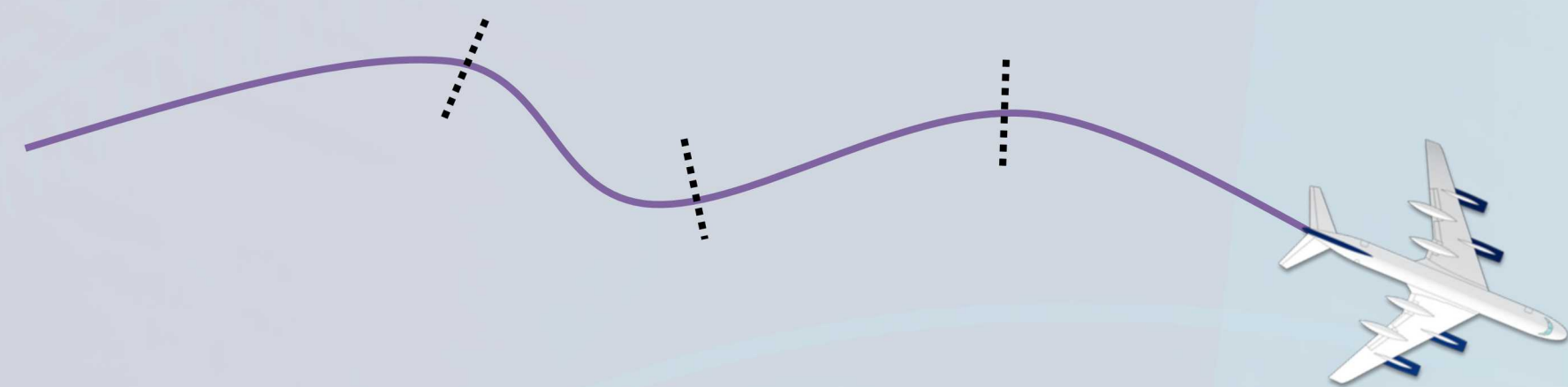
Efficiently Sub-dividing the Paths of Moving Objects for Better Analysis

Sandia National Laboratories

Benjamin D. Newton, M.Danny Rintoul, Chris Valicka, and Andy T. Wilson
Sandia National Laboratories, New Mexico

Problem

Tracktable enables complex data analytics for **national security applications** that include tracks or trajectories (the paths of moving objects). Additional insights can be gained by dividing whole trajectories into smaller segments or “sub-tracks” to which semantic information can be attached. **But how and where should a trajectory be split?**



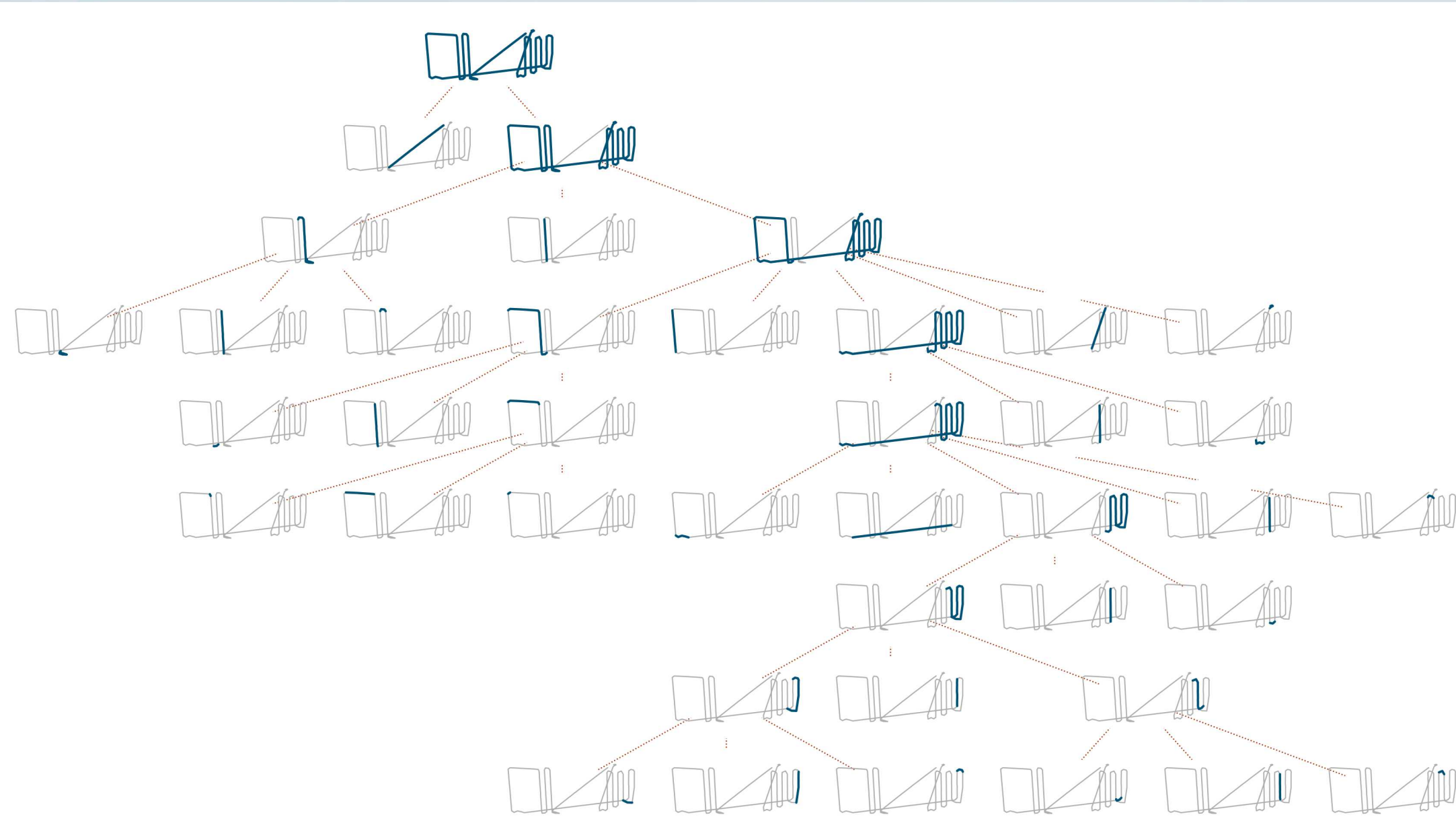
Approach

Straightness = the ratio of the length of a trajectory segment (along the path) to the Euclidean distance from the starting point to the ending point of the segment

“Sub-track-tion” Algorithm:

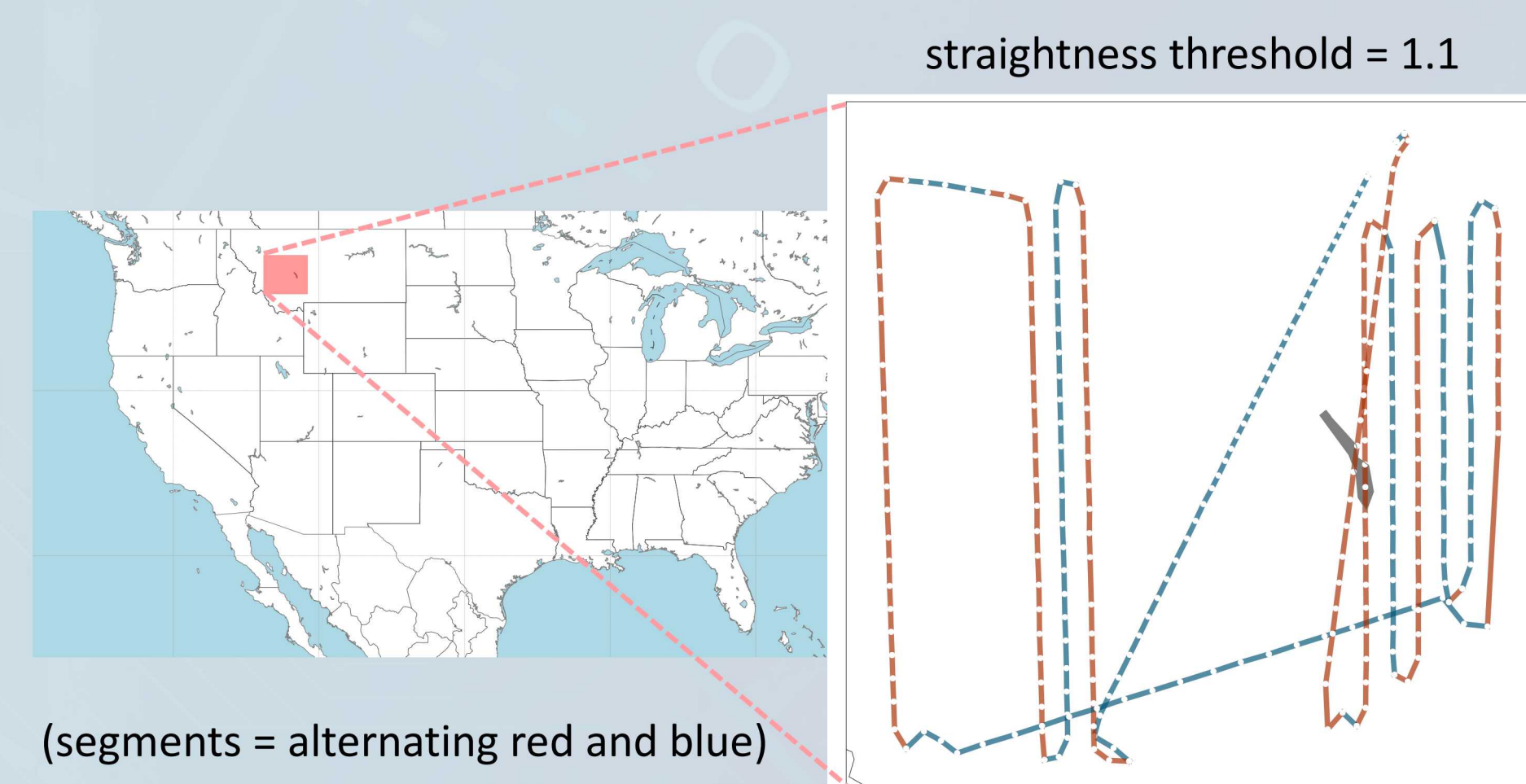
- Find the longest segment (in numbers of samples) which has a **straightness** below a given straightness threshold
- Slice the segment from the trajectory, and recurse on the remaining pieces (as long as they have more than a given number of samples – if the length threshold is used).

Hierarchical decomposition into segments:

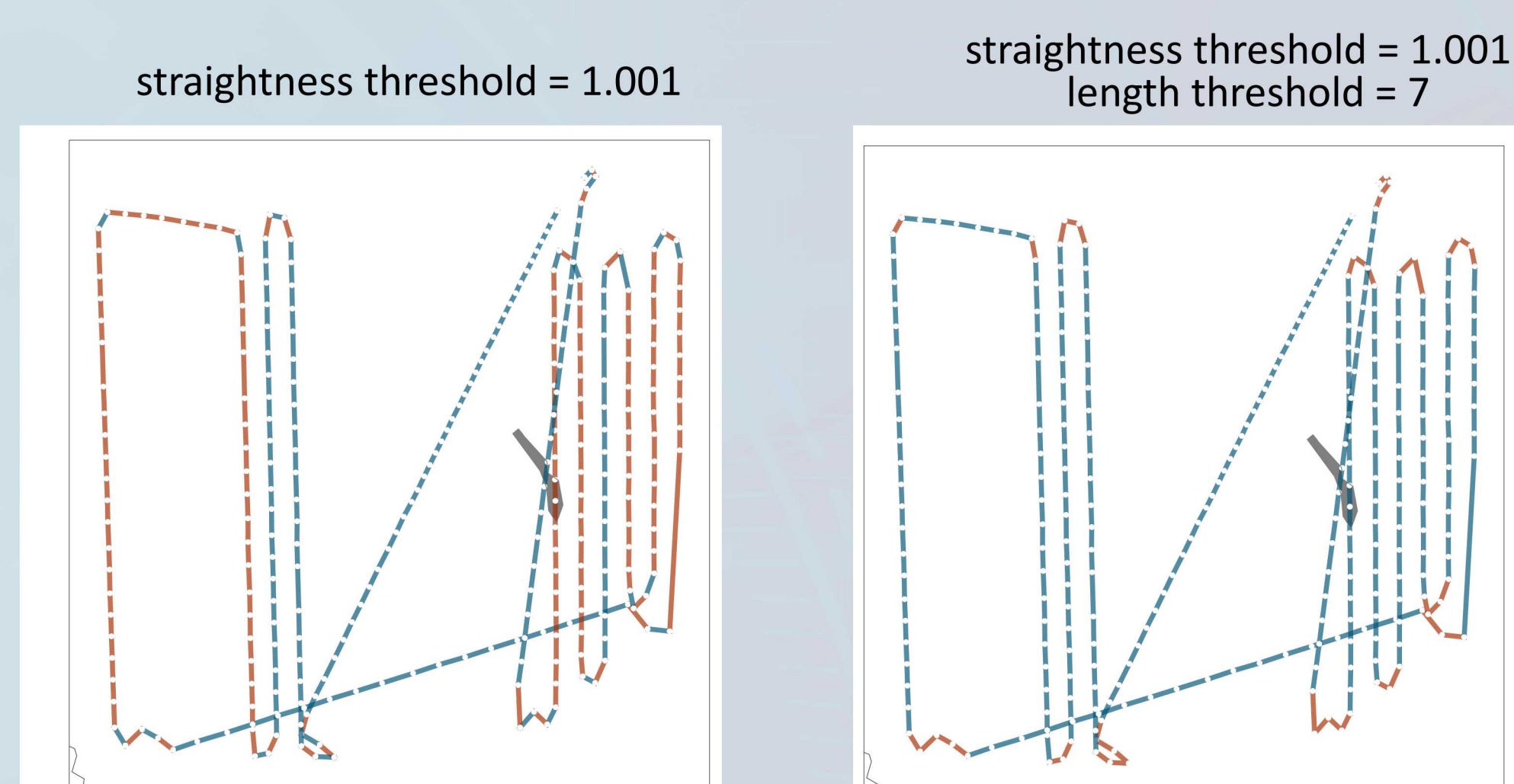


Results

Parameter Selection – Mapping Flight Example



Above: straightness threshold is too small, parts of the turns are included with straight segments



Above left: reduced straightness threshold, curve segments now sequences of straight segments. **Above Right:** Stopping the recursion whenever a segment length becomes smaller than a length threshold yields desired results

Significance

Rather than working exclusively with whole trajectories, segments of trajectories can now be analyzed. For example, searching for ordered sets of segments types (a U-turn followed by a straight segment) or reporting the percentage of each segment type in a trajectory (90% straight segments, 10% turns), etc.

Once integrated into Tracktable these enhancements will increase our ability to analyze, categorize, and organize trajectories.