Eric Yao

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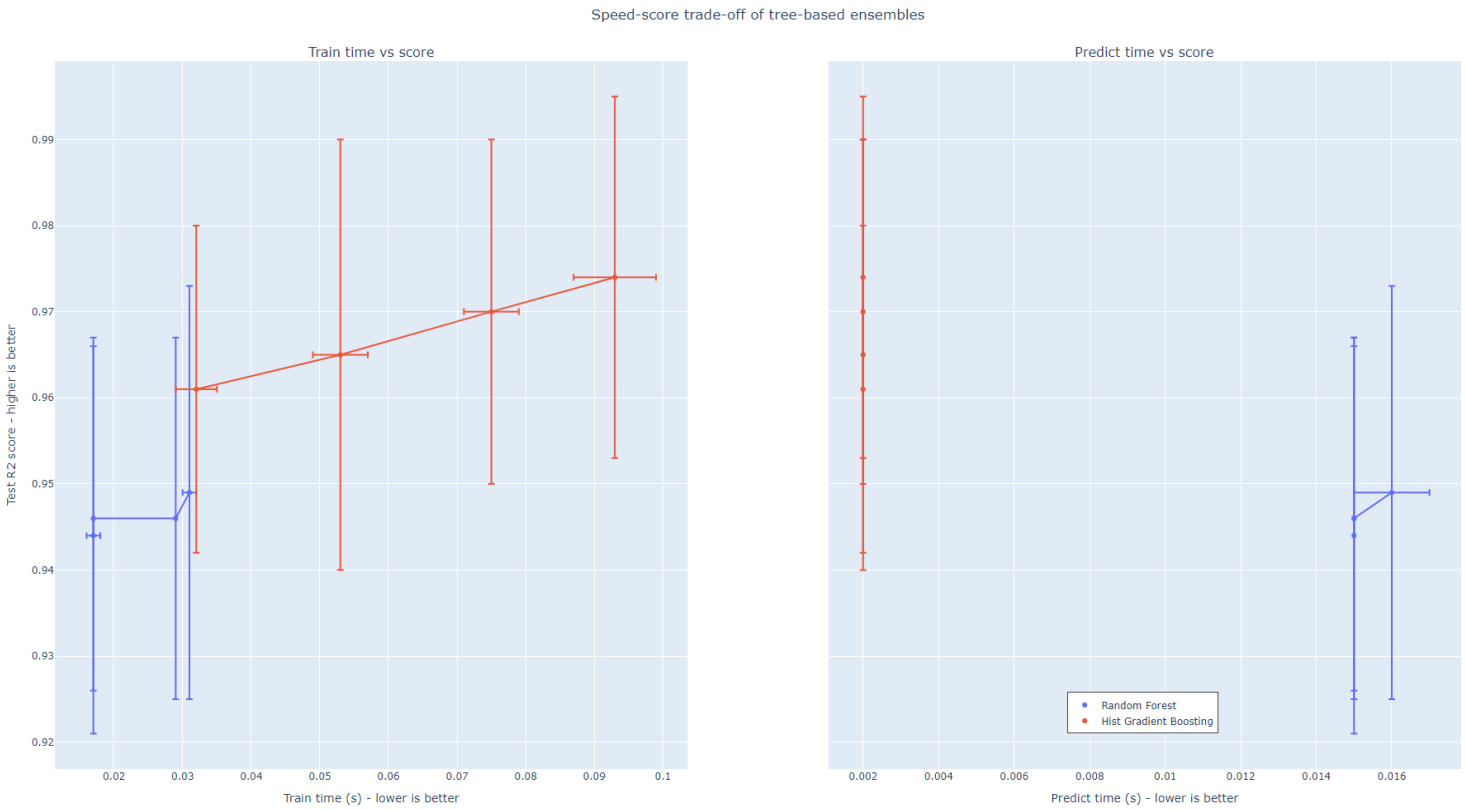

Question 4

Part 1

Rocky = 2 km/h = 30 min per km
Sandy = 3 km/h = 20 min per km
Smooth = 5 km/h = 12 min per km

Route 1 is 5 km long. There is a 20% chance it is sandy, 30% chance it is smooth, and a 50% chance it is rocky.
Sandy: (5 * 20) = 100 min, Smooth: (12 * 5) = 60 min, Rocky: (5 * 30) = 150 min.
100 * 0.2 + 60 * 0.3 + 150 * 0.5 = 113
Route 1 has an expected value of 113 minutes.

Route 2 is 7 km long. There is a 40% chance it is sandy, a 20% chance it is smooth, and a 40 % chance it is rocky.
Sandy: (7 * 20) = 140 min, Smooth: (12 * 7) = 84 min, Rocky: (7 * 30) = 210 min
140 * 0.4 + 84 * 0.2 + 210 *0.4 = 156.8
Route 2 has an expected value of 156.8 minutes.

Route 3 is 6 km long. There is a 50% chance it is sandy, a 40% chance it is smooth, and a 10% chance it is rocky.
Sandy: (6 * 20) = 120 min, Smooth: (6 * 12) = 72 min, Rocky: (6 * 30) = 180 min
120 * 0.5 + 72 * 0.4 + 180 * 0.1 = 106.8
Route 3 has an expected value of 106.8 minutes.

You should take route 3.

Part 2

Route 1 contains a crater. If the wall of the crater is intact, we can take a shortcut through the crater, which will save 20 minutes. If the wall has been damaged, we will need to go around, which will add 15 minutes to our journey. There is a 30% chance that the wall is damaged.
(113 - 20) * 0.7 + (113 + 15) * 0.3 = 103.5 min

Route 3 contains a bridge. If that bridge is damaged, we will need to repair it, which will add 40 minutes to our time. There is a 60% chance that the bridge is damaged.
106.8 * 0.4 + (106.8 +40) * 0.6 = 130.8 min

Route 1 saves more time

Part 3

Now we have an additional piece of potential information. There is an orbiting satellite that can tell us whether route 2 is rocky or not. If not, that would be great news, and would make it much more appealing! The only problem is that the satellite is not yet in position. How long should we wait for the satellite?

First: If the satellite said that route 2 was not rocky, how long would we expect it to take?

Sandy: (7 * 20) = 140 min, Smooth: (12 * 7) = 84 min
*140 * (⅔) + 84 * (⅓) = 121.333 min*

Second: What's the probability that the satellite will tell us this?
60% of the time, the satellite will tell us the path is NOT rocky.

Third: If the satellite tells us route 2 is in fact rocky, what do we do? How long will that take?
We will take route 1 assuming that the crater exists. That would take 103.5 minutes on average.

Last: given all of this, how long should we wait for the satellite?
We should never wait for the satellite since route 1 will always give us a faster average travel time regardless of whether or not the second path is rocky or not.