



Problem 1**Part 2**

Thanh Cong Nguyen

n_estimators	criterion	mean_accuracy
10	gini	0.870000
25	gini	0.943810
50	gini	0.932857
10	entropy	0.886825
25	entropy	0.921587
50	entropy	0.910317

Part 3

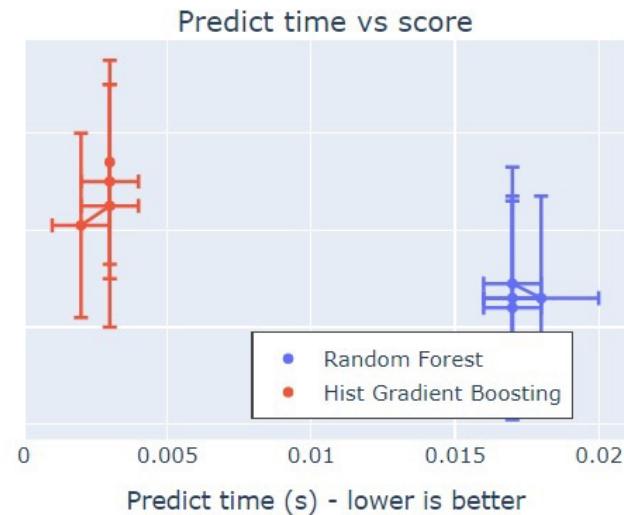
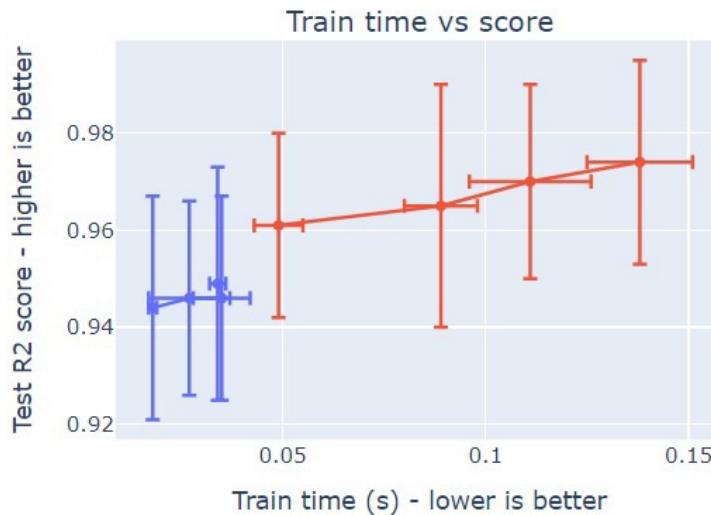
Model: Random Forest

	mean_fit_time	std_fit_time	...	mean_train_score	std_train_score
0	0.019624	0.002558	...	0.971002	0.005630
1	0.034013	0.008302	...	0.980226	0.005208
2	0.037480	0.007028	...	0.981986	0.001647
3	0.034993	0.005786	...	0.982866	0.002143

Model: Hist Gradient Boosting

	mean_fit_time	std_fit_time	...	mean_train_score	std_train_score
0	0.049333	0.002617	...	0.989456	0.002557
1	0.088954	0.005264	...	1.000000	0.000000
2	0.105162	0.012207	...	1.000000	0.000000
3	0.147699	0.014340	...	1.000000	0.000000

Speed-score trade-off of tree-based ensembles



Thanh Cong Nguyen

Problem 4:

Rocky terrain: $2 \text{ Km/h} = 60 / 2 = 30 \text{ mins/Km}$

Sandy terrain: $3 \text{ Km/h} = 60 / 3 = 20 \text{ mins/Km}$

Smooth terrain: $5 \text{ Km/h} = 60 / 5 = 12 \text{ mins/Km}$

Part 1: Route 1 = $(0.2 * 20 + 0.3 * 12 + 0.5 * 30) * 5$
 $= 22.6 * 5 = 113 \text{ mins}$

Route 2 = $(0.4 * 20 + 0.2 * 12 + 0.4 * 30) * 7$
 $= 22.4 * 7 = 156.8 \text{ mins}$

Route 3 = $(0.5 * 20 + 0.4 * 12 + 0.1 * 30) * 6$
 $= 17.8 * 6 = 106.8 \text{ mins}$

\Rightarrow We should pick route 3

Part 2

Route 1: If wall intact (70% chance): $113 - 20 = 93$ mins
If wall damaged (30% chance): $113 + 15 = 128$ mins
 $\rightarrow 0.7 \times 93 + 0.3 \times 128 = 103.5$ mins

Route 3: If bridge damaged (60% chance): $106.8 + 40 = 146.8$ mins
If bridge intact (40% chance): 106.8 mins (no additional time)
 $\rightarrow 0.6 \times 146.8 + 0.4 \times 106.8 = 130.8$ mins
 \Rightarrow Now, route 1 seems best.

Part 3:

First: If route 2 is not rocky, it means that would either be sandy or smooth.

$$P(\text{Sandy}) = \frac{40\%}{60\%} = \frac{2}{3} \text{ chance}$$

$$P(\text{Smooth}) = \frac{20\%}{60\%} = \frac{1}{3} \text{ chance}$$

$$\begin{aligned}\text{Route 2 : } & \left(\frac{2}{3} * 20 + \frac{1}{3} * 12 \right) * 7 = (13.34 + 4) * 7 \\ & = 121.38 \text{ mins}\end{aligned}$$

Second: The probability that route 2 is not rocky is simply the probability that it is either sandy or smooth:

$$P(\text{not rocky}) = 1 - P(\text{rocky}) = 1 - 0.4 = 0.6 (60\%)$$

So, there's a 60% chance the satellite will say route 2 is not rocky.

Third: If route 2 is confirmed to be rocky:

$$30 \text{ min/Km} * 7 \text{ Km} = 210 \text{ mins}$$

\Rightarrow We would stick with our previous best route, Route 1, which has an expected utility of 103.5 minutes (after counting for the crater)

Last: * If the satellite says route 2 is not rocky (60% chance)

- Best expected utility = 103.5 mins (route 1)

* If the satellite says route 2 is rocky (40% chance)

- Best expected utility = 103.5 mins (route 1)

The expected utility if we ask for the satellite is:

$$0.6 \times 103.5 + 0.4 \times 103.5 = 62.1 + 41.4 = 103.5 \text{ mins}$$

\Rightarrow Since the expected utility if we ask would be the same as route 1's time of 103.5 mins \Rightarrow It adds no benefit and only increase our travel time if we wait for the

Satellite

=> Therefore, we should proceed with route 1 without waiting.