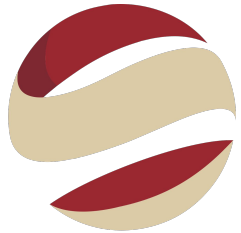
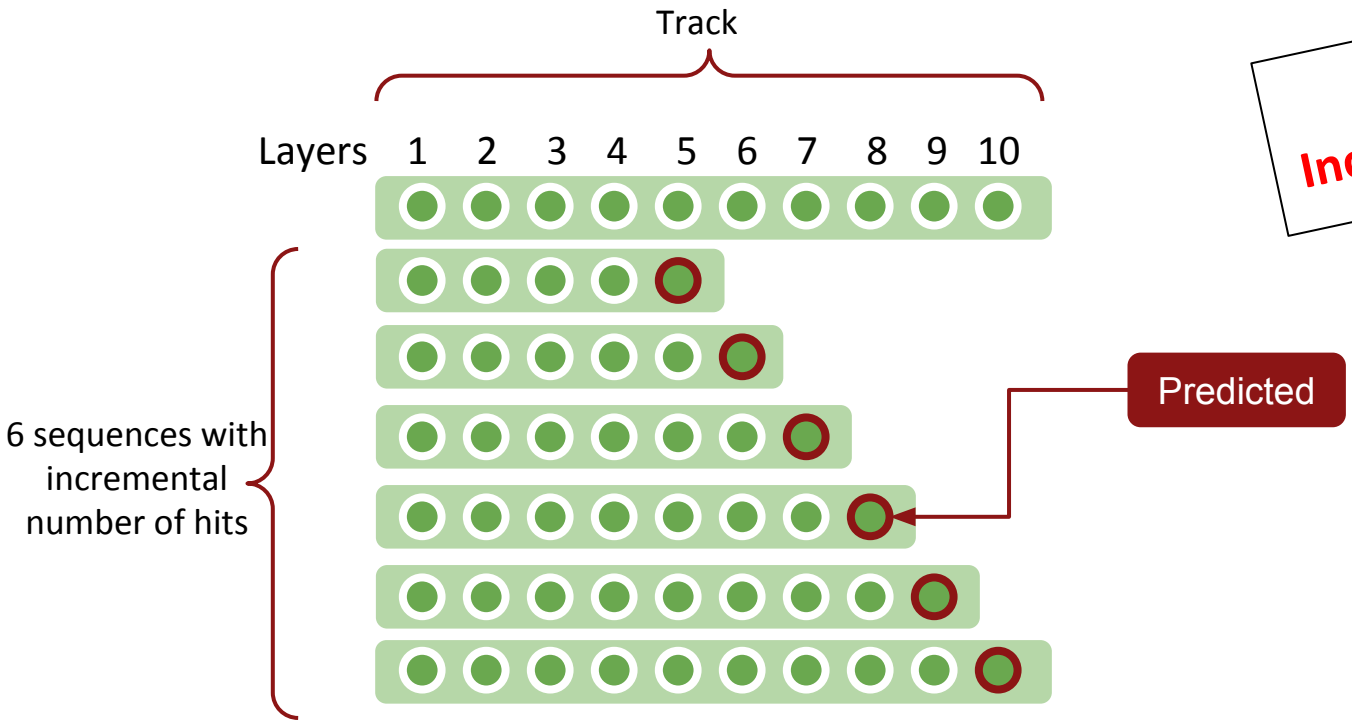


Track Reconstruction with BDT and Average of Seeds

Angelo Santos - 19 / Nov / 2020

SPRACE

Training Step: Preparation of Input Data Set



Currently: Incremental way

Weighted Average of Predictions (I)

Before training step

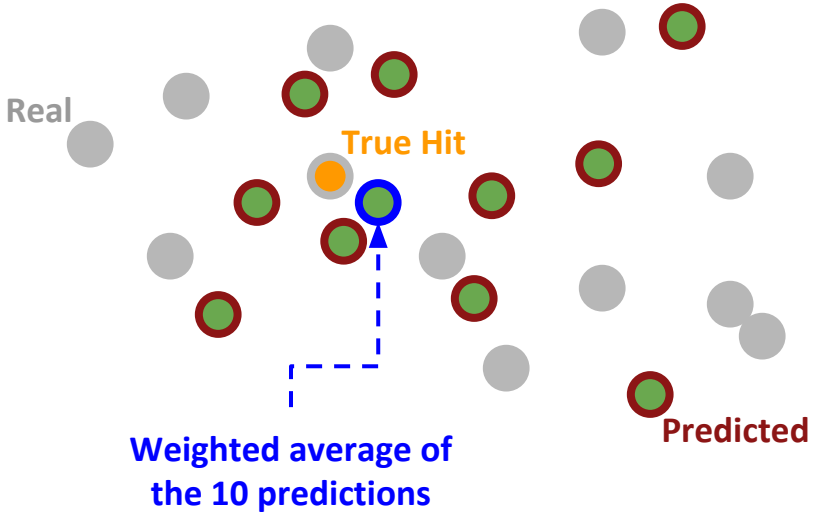
- Call a seed
  - Previously use 123 as seed
  - Now trying 10 different ones
    - 120
    - 121
    - …
    - 129

Optimization of parameters

- 10 seeds x 3 coord. x 6 layers = 180 times

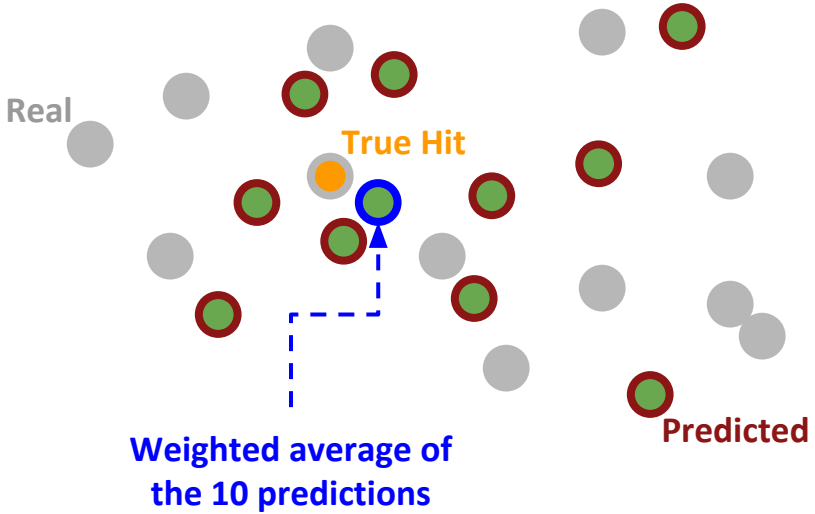
Application step

- Prediction is the weighted average of the 10 different predictions (based on MSE)



Weighted Average of Predictions (II)

$$x_{Layer}^{Pred} = \frac{\sum_{Seed=120}^{129}(x_{Layer,Seed}^{Pred} \times \frac{1}{MSE_{Layer,Seed}})}{\sum_{Seed=120}^{129} \frac{1}{MSE_{Layer,Seed}}}$$



Mean Squared Error (MSE)

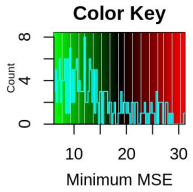
Layer	5	6	7	8	9	10
Currently (Incremental Way) + 10 Seeds						
Avg. Total MSE (mm^2)	7.5	7.2	10.6	143.6	42.7	66.4
Avg. RSME (mm)	2.7	2.7	3.3	12.0	6.5	8.1
Currently (Incremental Way)						
Total MSE (mm^2)	7.5	7.2	10.4	142.1	42.8	66.8
RSME (mm)	2.7	2.7	3.2	11.9	6.5	8.2
Previously (Sequence of 5 Hits)						
Total MSE (mm^2)	10.3	8.1	12.4	169.5	44.9	72.9
RSME (mm)	3.2	2.9	3.5	13.0	6.7	8.5

Successes (No Dataset Update)

Layers	5	6	7	8	9	10	Whole Track
Sequences of 5 hits (Euclidean Distance)							
Success	5125 (85%)	5084 (85%)	5017 (84%)	4820 (80%)	4445 (74%)	4426 (74%)	**3280 (55%)**
Sequences of 5 hits (Cosine Similarity)							
Success	5178 (86%)	5202 (87%)	5132 (86%)	4956 (83%)	4570 (76%)	4495 (75%)	**3415 (57%)**
Incremental way (Euclidean Distance)							
Success	5430 (90%)	5355 (89%)	5262 (88%)	4980 (83%)	4610 (77%)	4631 (77%)	**3532 (59%)**
Incremental way (Cosine Similarity)							
Success	5500 (92%)	5481 (91%)	5387 (90%)	5085 (85%)	4714 (79%)	4704 (78%)	**3642 (61%)**
Incremental way + 10 Seeds (Euclidean Distance)							
Success	**5462 (91%)**	5423 (90%)	5360 (89%)	5090 (85%)	4753 (79%)	4820 (80%)	**3768 (63%)**
Incremental way + 10 Seeds (Cosine Similarity)							
Success	**5537 (92%)**	5549 (92%)	5486 (91%)	5223 (87%)	4865 (81%)	4936 (82%)	**3937 (66%)**

BACKUP

Optimization Step



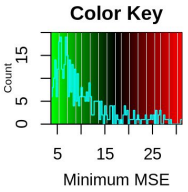
Minimu MSE for x (Layer 5)

Previously

	2	4	6	8	10	12	14	16	18	20	Learning Rate
0.02	15.7	14.4	13.2	11.7	10.5	9.4	8.6	7.8	7.2	6.7	
0.04	16.3	15	13.1	11.4	9.9	8.7	7.8	7.1	6.5	6.2	
0.06	18.5	15.3	13.7	11.7	10.3	9.2	8.2	7.3	6.8	6.6	
0.08	19.6	16.1	13.8	11.9	10.5	9.2	8.2	7.4	7	6.3	
0.1	23.5	17.5	14.3	12.2	10.8	9.4	8.8	7.7	6.6	6.3	
0.12	26.7	18.9	14.3	12.5	10.7	9.5	8.3	7.6	7.2	6.4	
0.14	27.9	21.2	16	13.3	11.1	9.6	8	7.8	7.3	6.9	
0.16	25.2	21.8	16.3	13.5	11.9	10.3	8.7	8.1	7.3	7.6	
0.18	25.9	24.7	16.9	13.7	11.7	10.4	8.9	8	8.3	6.8	
0.2	27.7	21.2	15.8	14.4	13	11.1	9.8	8.8	8.2	6.9	
0.22	26.7	26.5	19.1	15.1	13	11.5	10.4	9.8	8	8.4	
0.24	23.3	19.2	19.8	17.1	13.2	12	10.1	9	9.3	9.7	
0.26	27.5	20.2	20.6	16.4	14.2	13.3	11.1	9.4	8.8	9.2	
0.28	28.8	22	23.6	19.3	12.8	12	10.9	11.4	10.6	10.3	
0.3	26.3	24.7	25	20.2	15.1	13.4	12.8	12.1	10.1	9.8	
0.32	23.2	21	22.2	19.6	13.2	15.2	12.6	12.1	11.3	10.6	
0.34	24.5	19	25.8	20	16.1	13.9	11.1	13.4	11.3	10.5	
0.36	27.5	26.4	24.1	17.9	15.2	16.9	15.9	14.1	11.5	10.6	
0.38	22.8	31.2	26.5	21	17	12.7	14.3	13	12.4	12.1	
0.4	19.8	25.7	28.2	21.9	16.3	17.7	13.8	14.6	12.9	11.9	

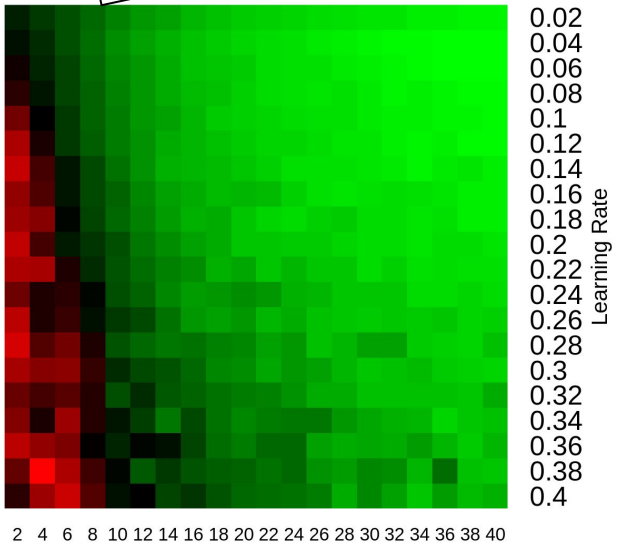
Tree Interaction Depth

Expansion of phase space



Minimu MSE for x (Layer 5)

Currently



Tree Interaction Depth