

# Depth is More Powerful than Width with Prediction Concatenation in Deep Forest

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Presented by Shen-Huan LYU



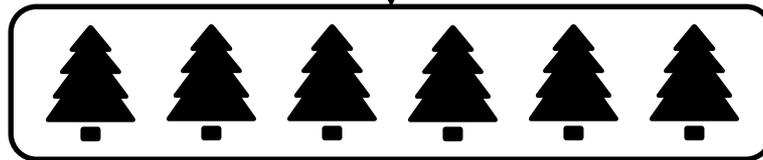
# Simplified Deep Forest

Original Input



Prediction Concatenation

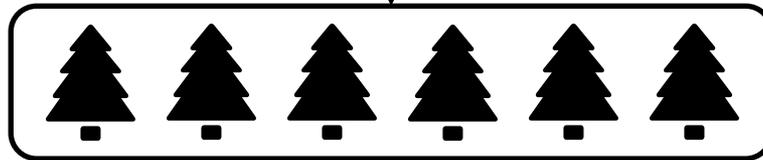
1<sup>st</sup> Random Forest



Prediction



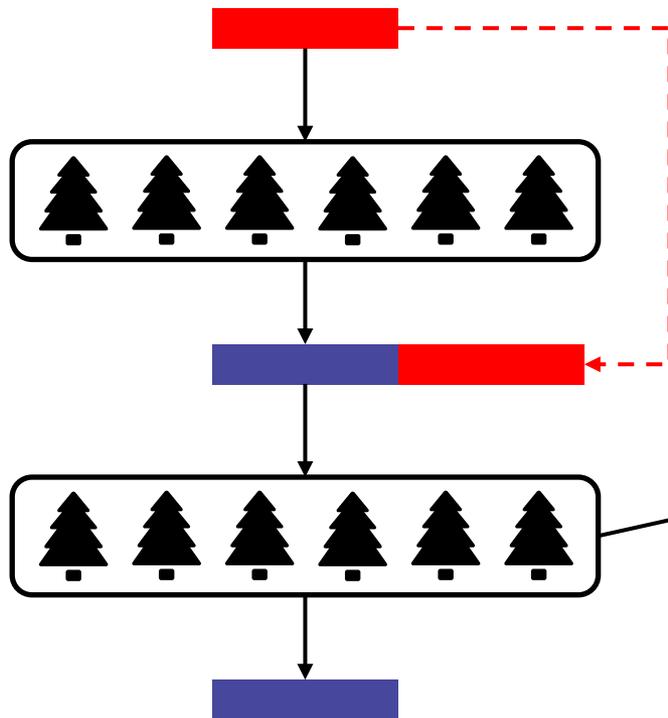
2<sup>nd</sup> Random Forest



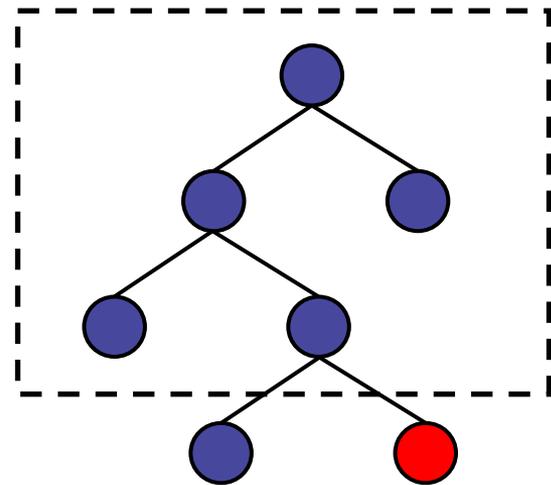
Final Prediction



# Priority of New Feature

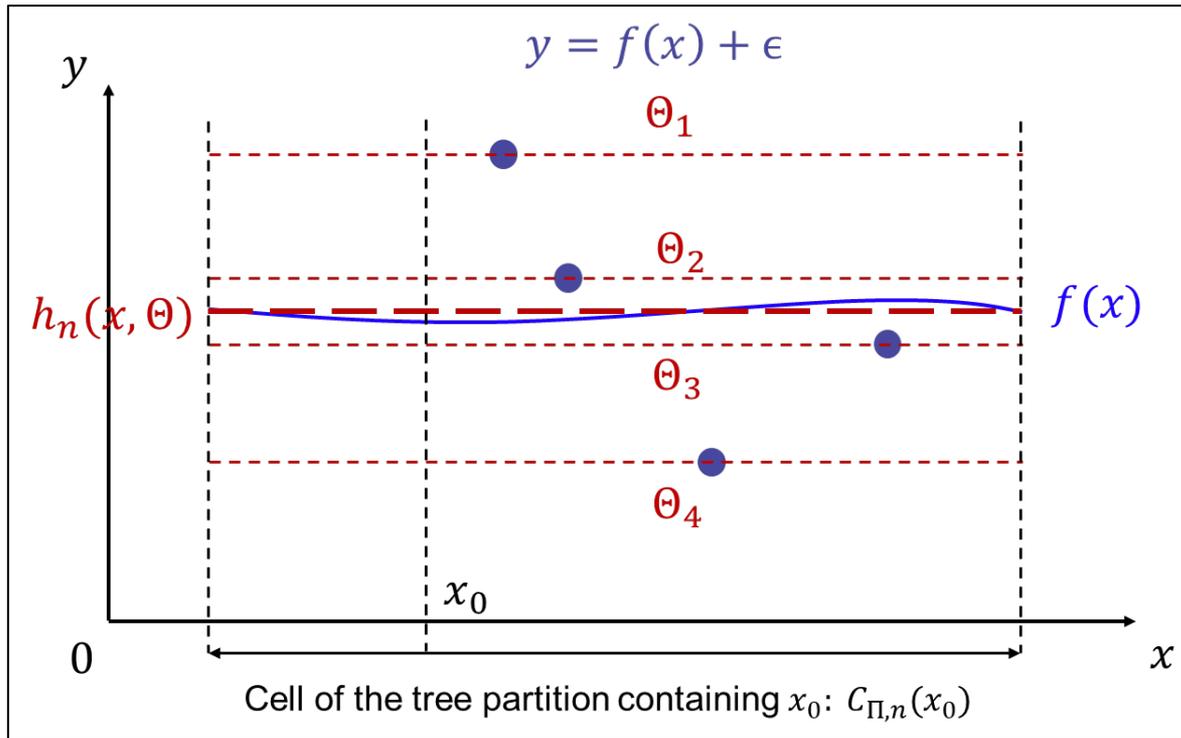


The first  $k$  splits in these CARTs are performed along the **new feature** only.

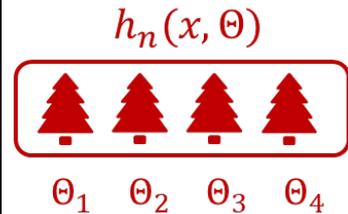


# Consistency

- Consistency of forest modules
  - Random Forest



$2M$  units



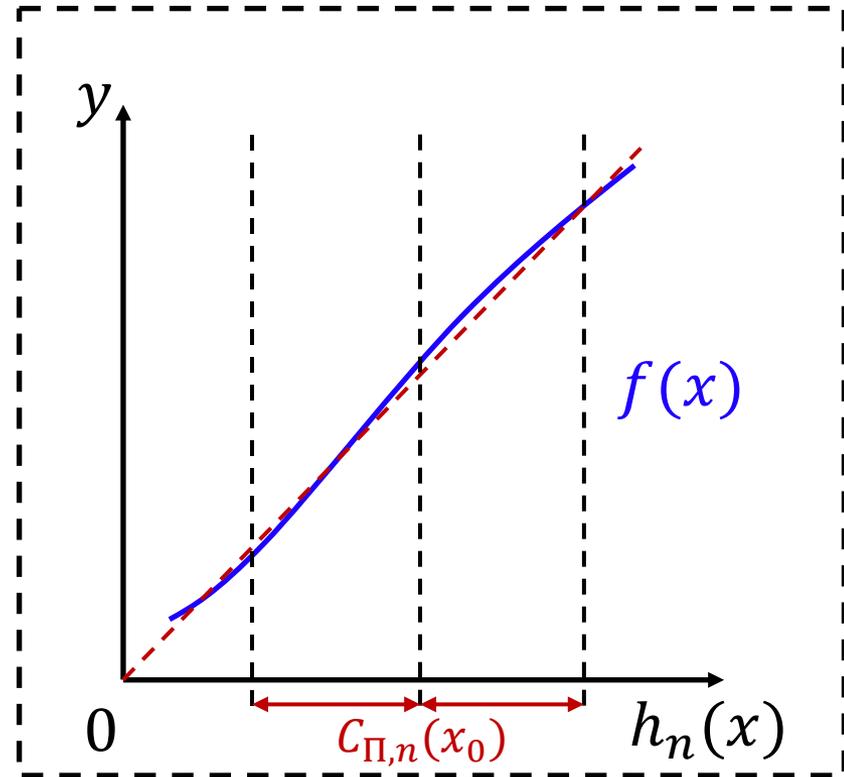
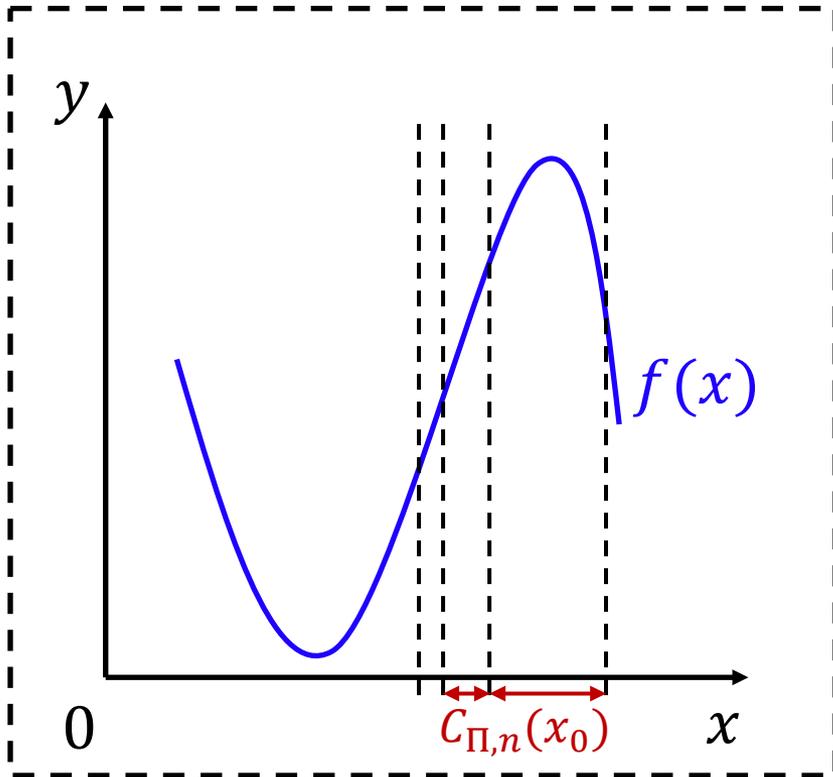
1. The variation of  $f(x)$  in the cell is small.
2. The number of connected points is sufficient.

$$R(h) \leq \mathcal{O}\left(\frac{1}{2M}\right)$$

# Consistency

- Consistency of forest modules
  - Simplified DF

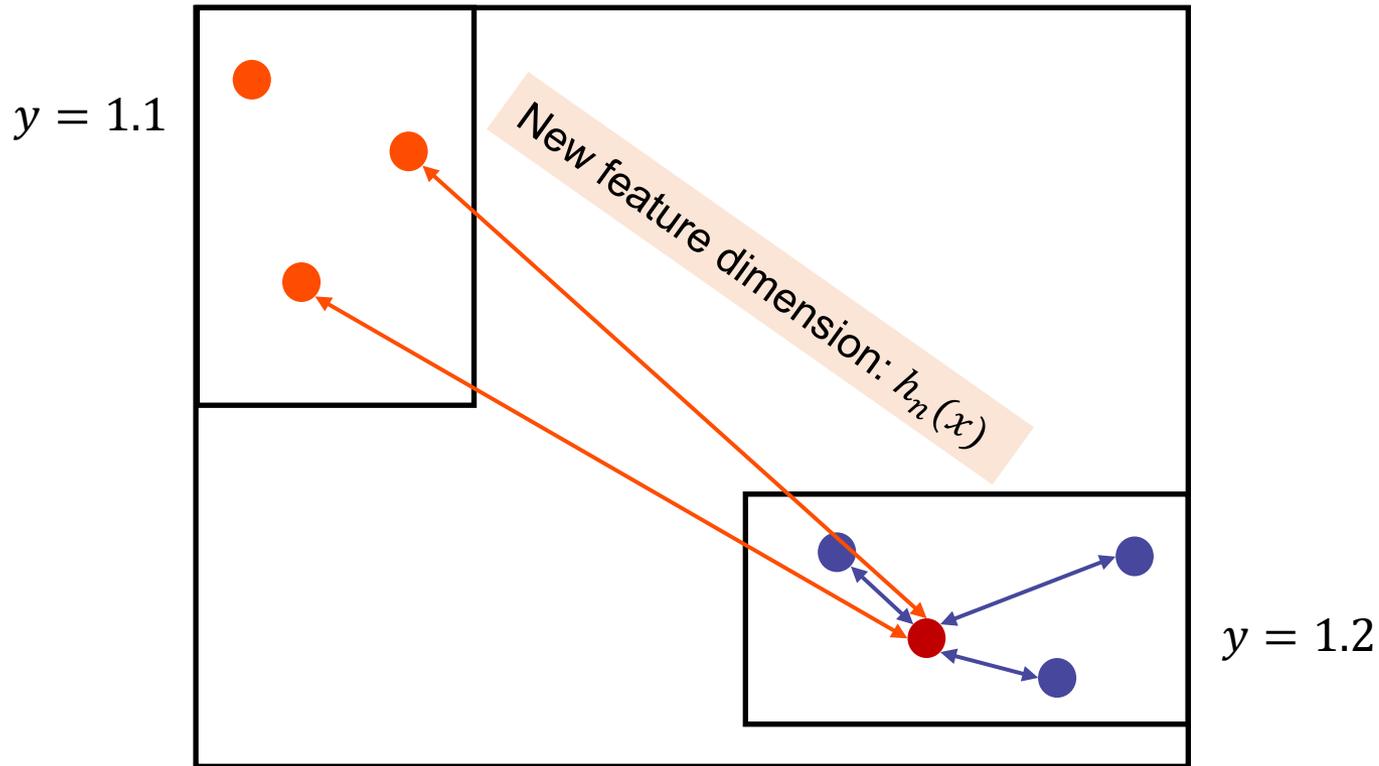
The first  $k$  splits in these CARTs are performed along the **new feature** only.



1. The variation of the  $f(x)$  is small.

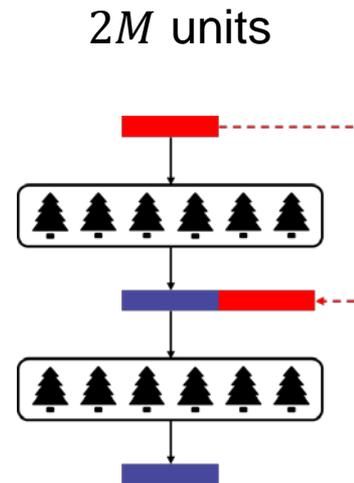
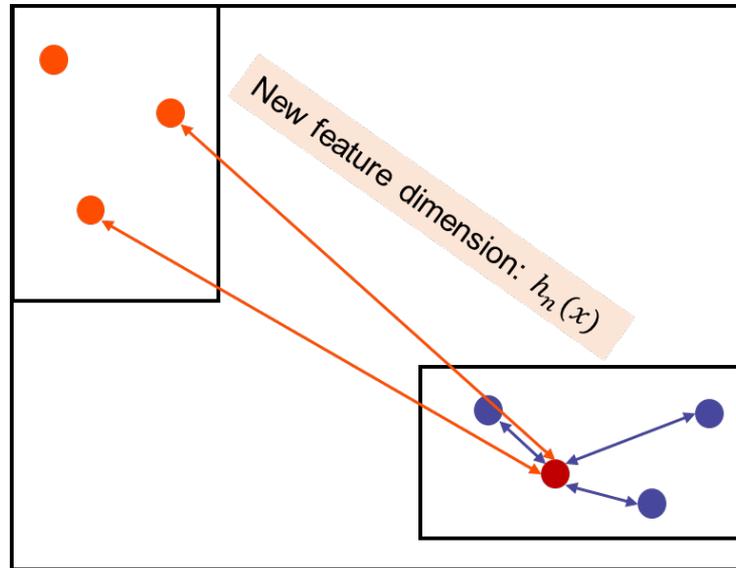
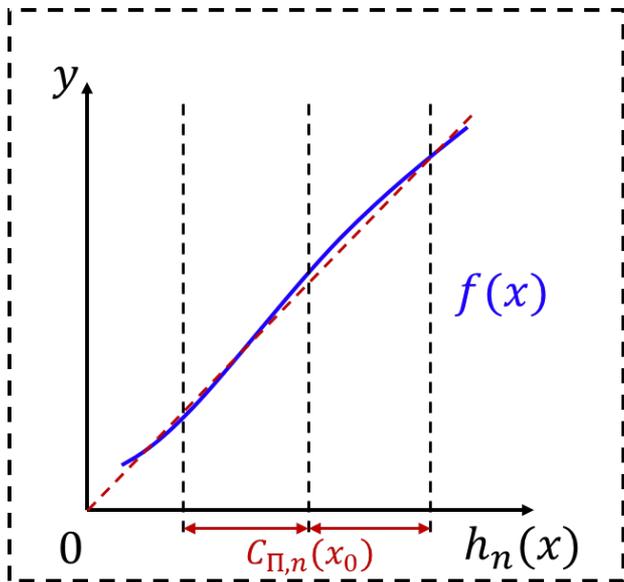
# Consistency

- Consistency of forest modules
  - Simplified DF



# Consistency

- Consistency of forest modules
  - Simplified DF

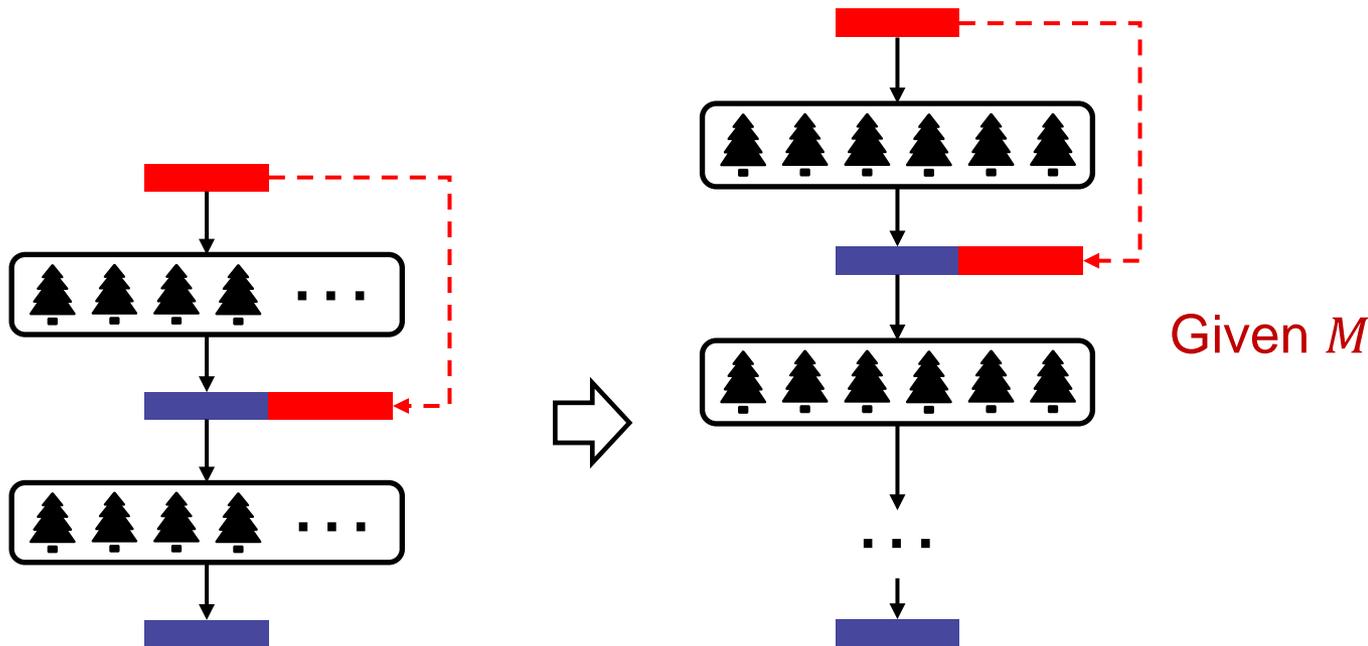


1. The variation of the  $f(x)$  is small.
2. The number of connected points is sufficient.

$$R(h) \leq \mathcal{O}\left(\frac{1}{M^2}\right)$$

# Conclusion & Discussion

- Consistency of Simplified DF
- Convergence rate *w.r.t.* the number of CARTs  $M$  is improved from  $1/M$  to  $1/M^2$
- Future work



Thanks!  
Q&A