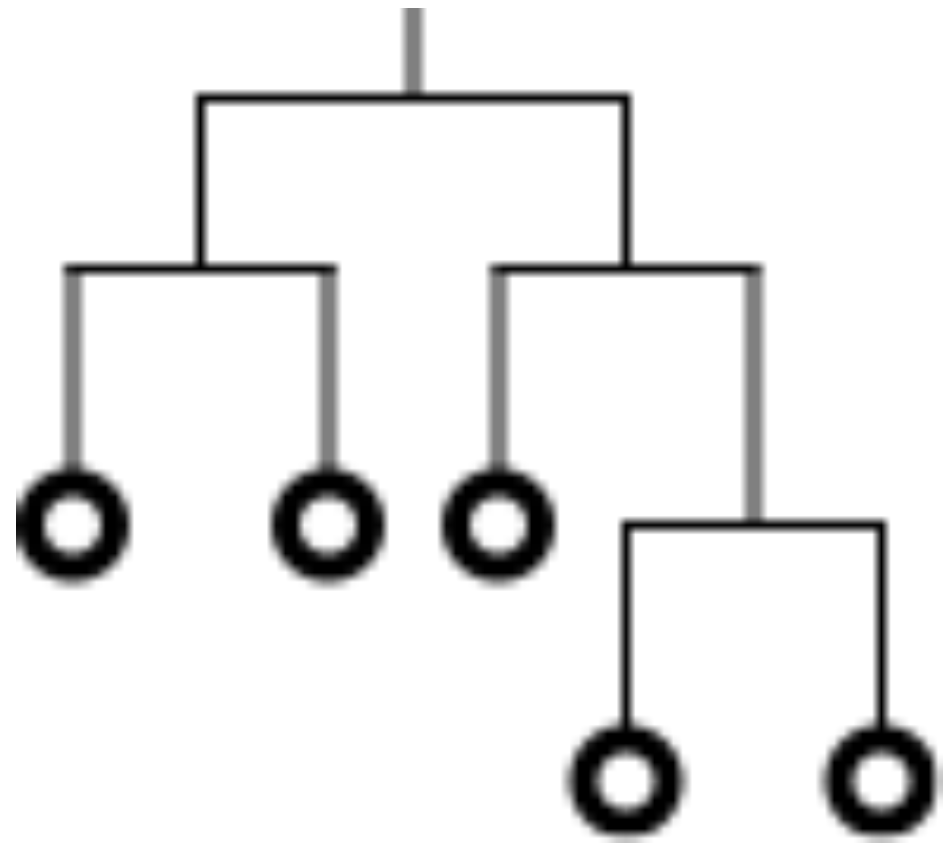
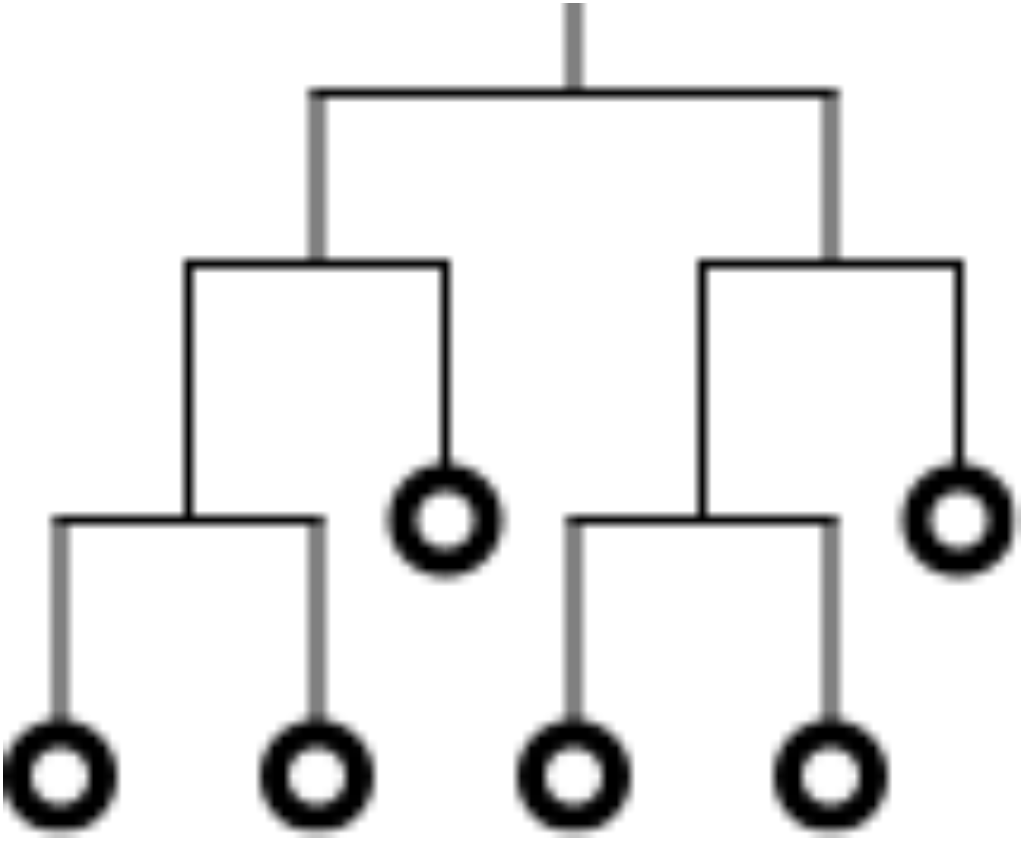
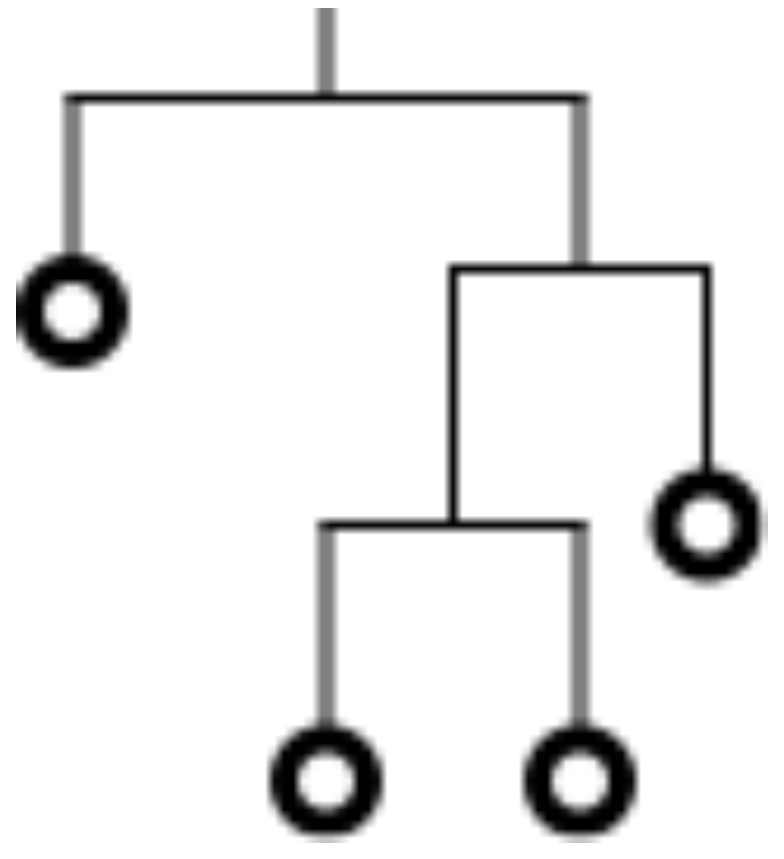
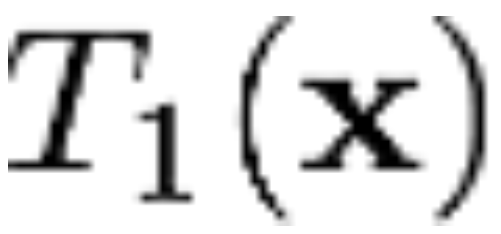

H2O.ai

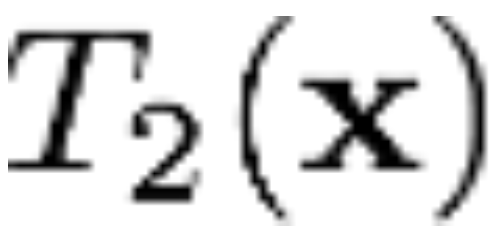
Gradient Boosting Machine (GBM)

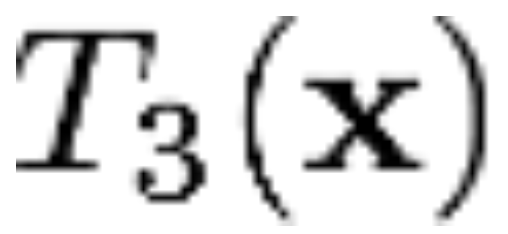


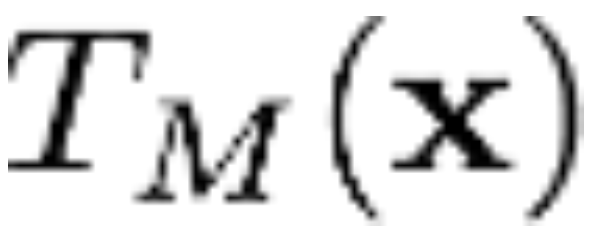












Algorithm 1 Forward Stagewise Additive Training

1: Initialize $f_0(\mathbf{x}) = 0$.
2: **for** $i = 1$ to M **do**
3: $\quad \hat{\Theta}_i = \arg\min_{\Theta_i} \sum_{i=1}^{n} L(y_i, f_{i-1}(x_i) + T(x_i; \Theta_i))$
4: $\quad f_i(\mathbf{x}) = f_{i-1} + T(\mathbf{x}; \hat{\Theta}_i)$
5: **end for**
6: $f(\mathbf{x}) = f_M(\mathbf{x})$

GBM Algorithm

Algorithm 10.3 *Gradient Tree Boosting Algorithm.*

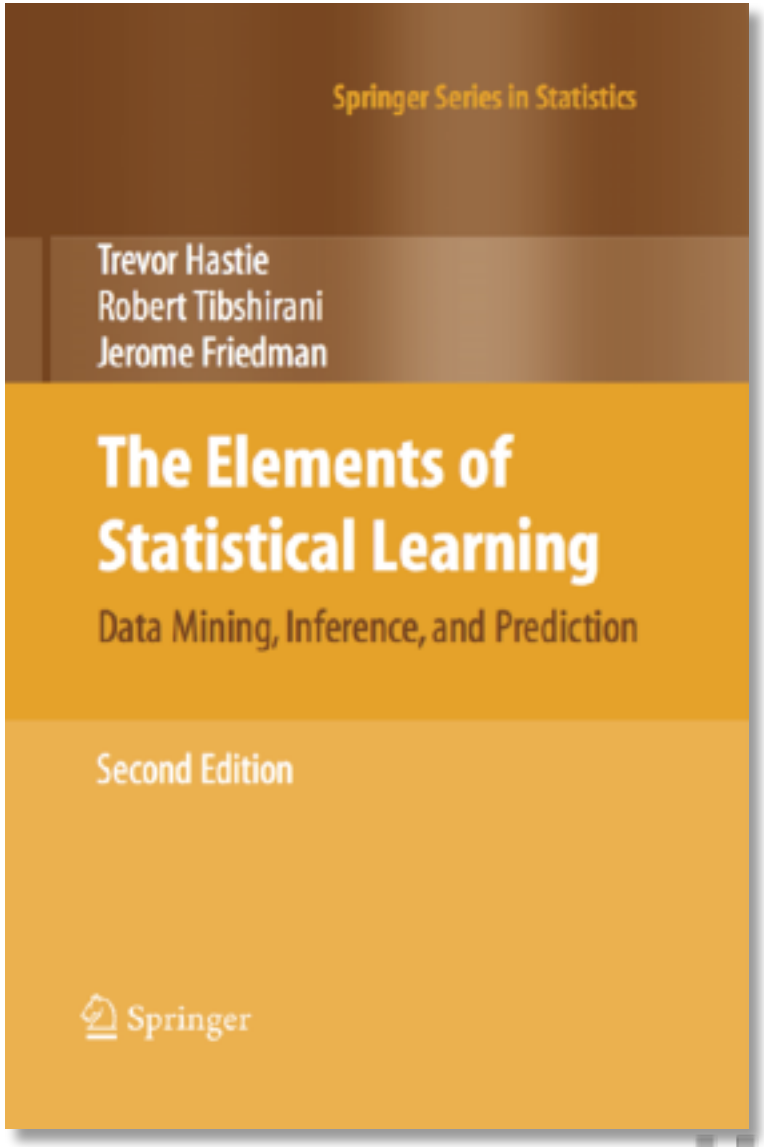
1. Initialize $f_0(x) = \arg\min_\gamma \sum_{i=1}^{N} L(y_i, \gamma)$.
2. For $m = 1$ to M:
   (a) For $i = 1, 2, \ldots, N$ compute

$$r_{im} = -\left[\frac{\partial L(y_i, f(x_i))}{\partial f(x_i)}\right]_{f=f_{m-1}}.$$

   (b) Fit a regression tree to the targets r_{im} giving terminal regions R_{jm}, $j = 1, 2, \ldots, J_m$.
   (c) For $j = 1, 2, \ldots, J_m$ compute

$$\gamma_{jm} = \arg\min_\gamma \sum_{x_i \in R_{jm}} L\left(y_i, f_{m-1}(x_i) + \gamma\right).$$

   (d) Update $f_m(x) = f_{m-1}(x) + \sum_{j=1}^{J_m} \gamma_{jm} I(x \in R_{jm})$.
3. Output $\hat{f}(x) = f_M(x)$.



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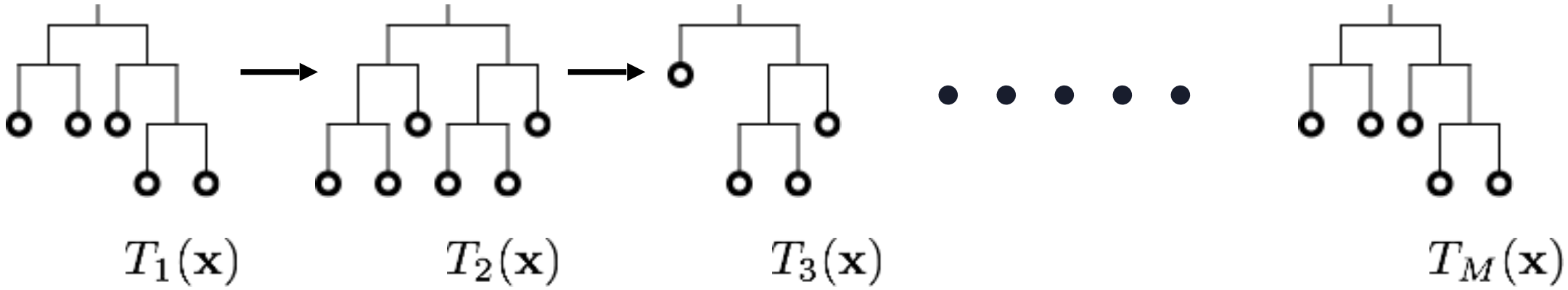

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