Deep learning

Joey F
Foundations for PINN

October 23, 2024

List of things will need for whole document

1. $0 \leq t_n \leq T, \quad t^{n+1} - t^n = \Delta T$
2. $\vec{Y} = \begin{pmatrix} \mathbf{y}_1 \\ \mathbf{y}_2 \\ \vdots \\ \mathbf{y}_n \end{pmatrix}$
3. $N\Delta T = T$
4. $\vec{Y} \in \mathbb{R}^{dN}$,
5. $T^0 = 0$
6. $T^1 = \Delta T$
7. $T^2 = 2\Delta T$
8. $T^N = N\Delta T$
9. $\hat{y} \in \mathbb{R}^{(2N+1)d}$
10. $\mathbf{h}^0 \in \mathbb{R}^{2N+1}$
11. $\mathbf{h}^i \in \mathbb{R}^{(2N+1)d}, \quad 1 \leq i \leq d$
12. $k = 1, \ldots, l$
13. $\mathbf{h}^{(k)} =$ dim of Level k
14. $\mathbf{h}^{(1)} \in \mathbb{R}^{n^{(i)}}, \quad i = 0, \ldots, l$
15. $\mathbf{h}^{(1)} \in \mathbb{R}^{n^{(i)}}, \quad i = 0, \ldots, l$

16.
$$\frac{\vec{y}(T+\Delta T)+\vec{y}(t)}{\Delta T} = \vec{f}\left(\frac{\vec{y}(T+\Delta T)+\vec{y}(t)}{2}, \frac{T+\Delta T}{2}\right) \tag{1}$$

$$\mathbf{y}(0) = \mathbf{y}_0 \tag{2}$$

17. N samples of T^N

18. N samples of $T^N + \Delta T$

19. let
$$\frac{dy}{dx} = f(x,y) \tag{3}$$
be an ODE

20. 1 sample of $\mathrm{T}_0 = 0$

21.
$$\tilde{T}^{(m)}, \quad m = 0, \ldots, 2N+1 \tag{4}$$

22. $\mathrm{W} \in \mathbb{R}^{n^{(k)}} \times \mathbb{R}^{n^{(k-1)}}$

23.
$$\text{for } k = 1, \ldots, l \quad \vec{a}^k = \vec{b}^k + W^k \vec{h}^{(k-1)} \tag{5}$$

24.