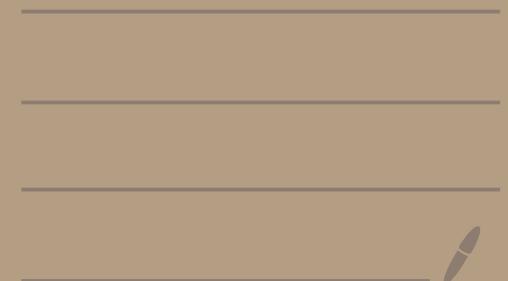


FYS5429/9429 February 5



FYS5429/9429 February 5

Solving ordinary differential
eqs (ODEs) and Partial
differential equations (PDEs)

$$\frac{dx}{dt} = \lambda x(t)$$

$$x(t_0) = x_0$$

Discretize

$$t \rightarrow t_i' = t_0 + i\Delta t$$

$$x(t) \rightarrow x(t_i') = x_i' \quad i = 0, 1, 2, \dots, n$$

$$\frac{d x(t)}{dt} = \frac{dx}{dt} = ?$$

$$x(t_i' \pm \Delta t) = x(t_i') \pm \Delta t \frac{dx}{dt} \Big|_{t=t_i'} + O(\Delta t^3)$$

$$+ \frac{1}{2!} (\Delta t)^2 \frac{d^2 x}{dt^2} \Big|_{t=t_i} + O(\Delta t^3)$$

$$\frac{dx}{dt} = \frac{x(t_i' + \Delta t) - x(t_i')}{\Delta t} + O(\Delta t)$$

$$\frac{dx}{dt} \approx \frac{x_{i+1} - x_i}{\Delta t} \Rightarrow$$

$$x_{i+1}' = x_i' + \Delta t \frac{dx}{dt}$$

$\sim \lambda x_i'$

$$g(x) = \left(\frac{dx}{dt} - \lambda x \right)$$

Cost function

$$C(x) = \frac{1}{n} \sum_{i=0}^{n-1} \left(\frac{dx}{dt} \Big|_{t=t_i} - \lambda x_i \right)^2$$

ansatz :

$$x_i' = \underbrace{h_1(t_i)}_{x_0 + t_i' NN(t_i'; \epsilon)} + \underbrace{h_2(t_i)}_{}$$