AME 508 Final Presentation

One-Dimension Wave Propagation

Zhilong Li
Wei-Hsuan Shih
Yiran You

Objective

The wave equation in one space dimension can be written as follows:

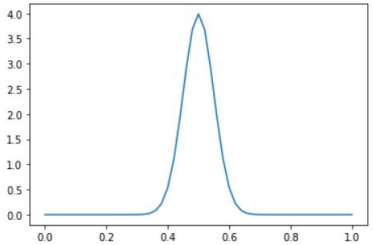
$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}.$$

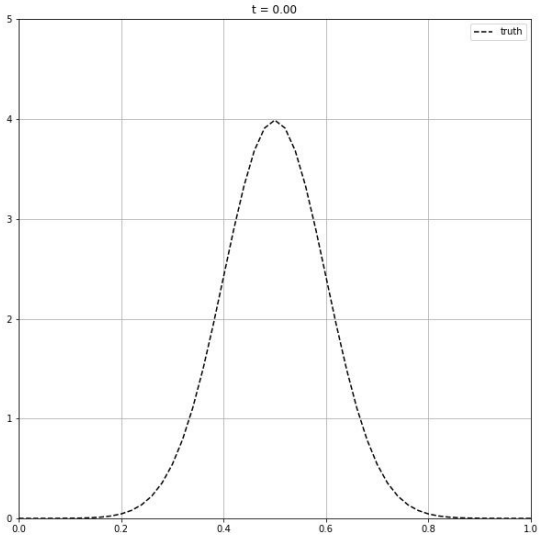
Two initial conditions are given below:

1. $u(x,\ t = 0,\ c) = f(x)$, and $f(x)$ is a gaussian distribution
2. $u_t(x,\ t = 0,\ c) = 0$

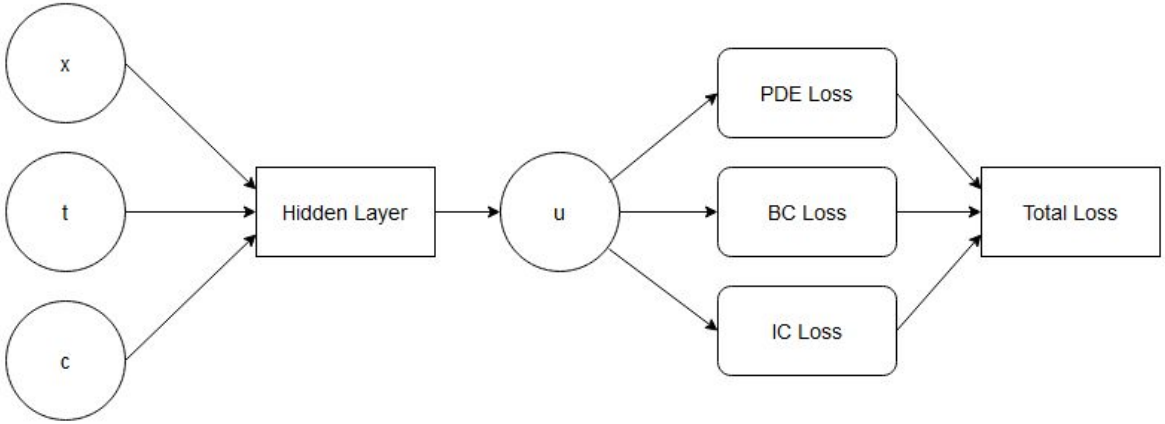
Two boundary conditions are given :

1. $u_x(x = 0,\ t,\ c) = 0$
2. $u_x(x = L,\ t,\ c) = 0$



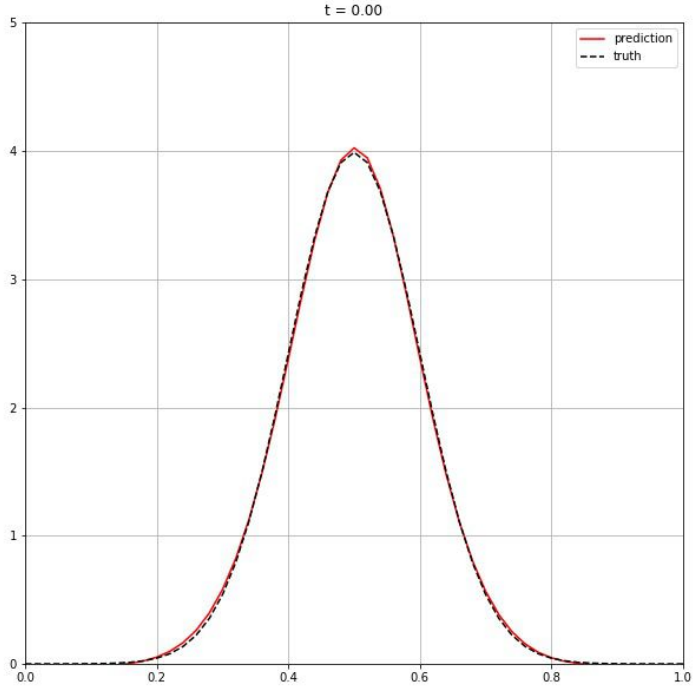


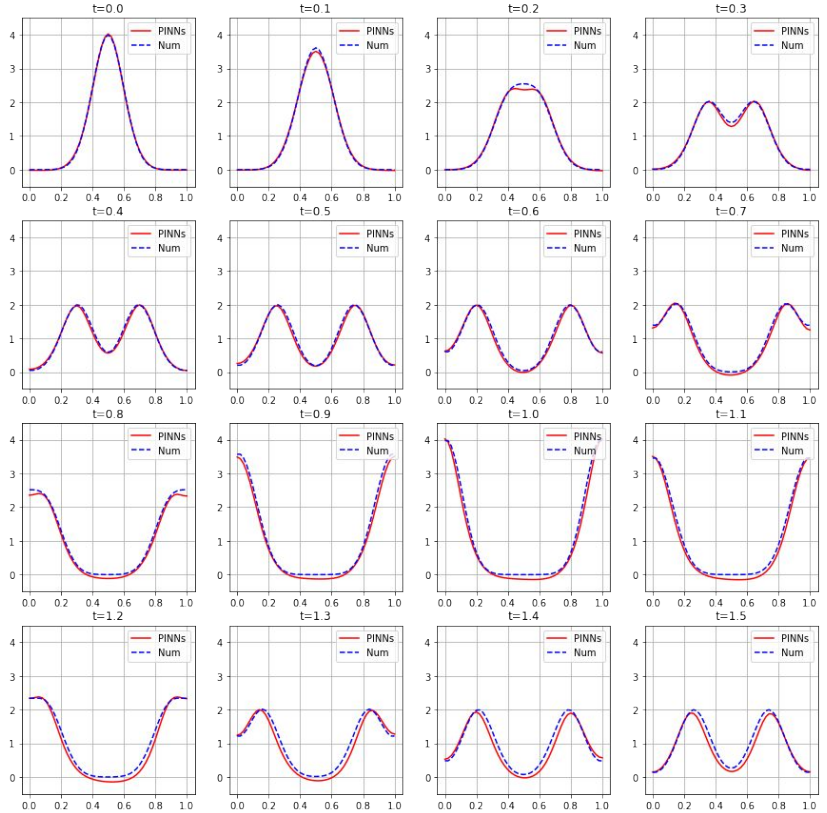
Architecture



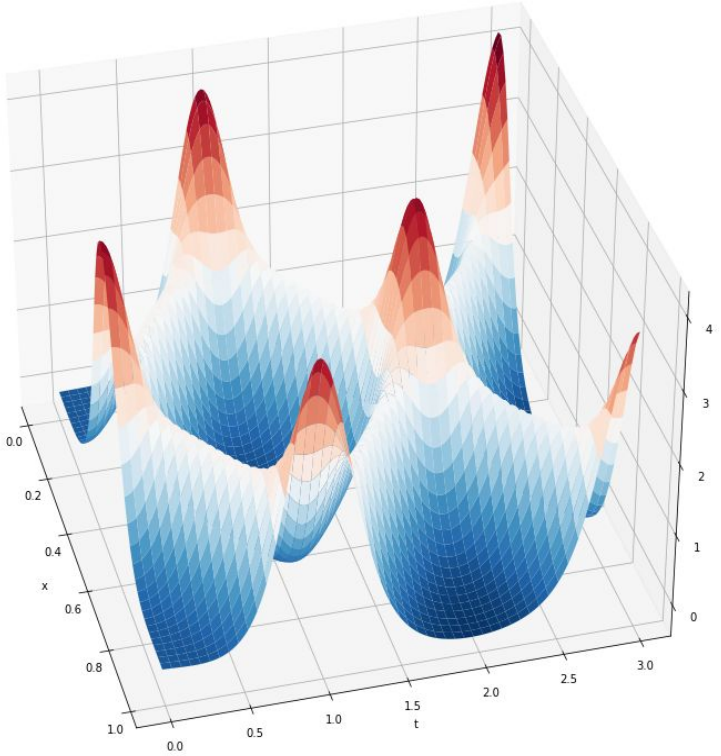
- Input dimension d = 3
- Output dimension D = 1
- Depth = 10
- Width = 20
- Activation function = tanh
- No activation function at the output layer

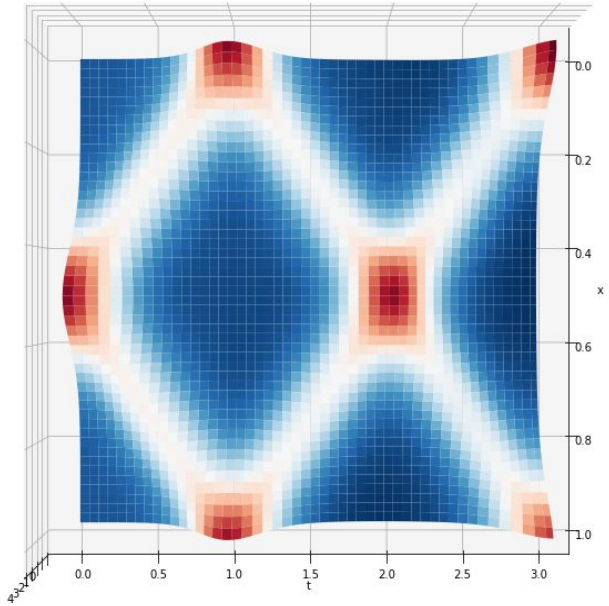
Results and Discussion



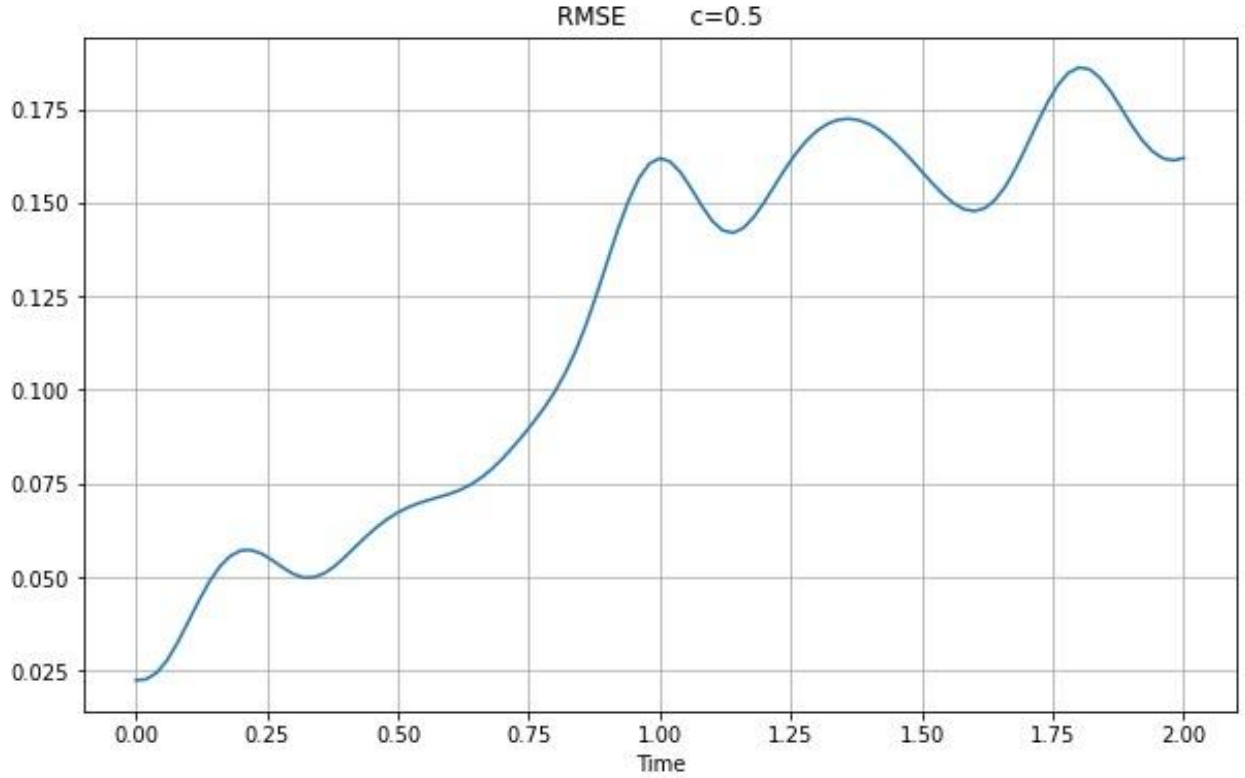


Overplot of predicted results and numerical results at c = 0.5m/s



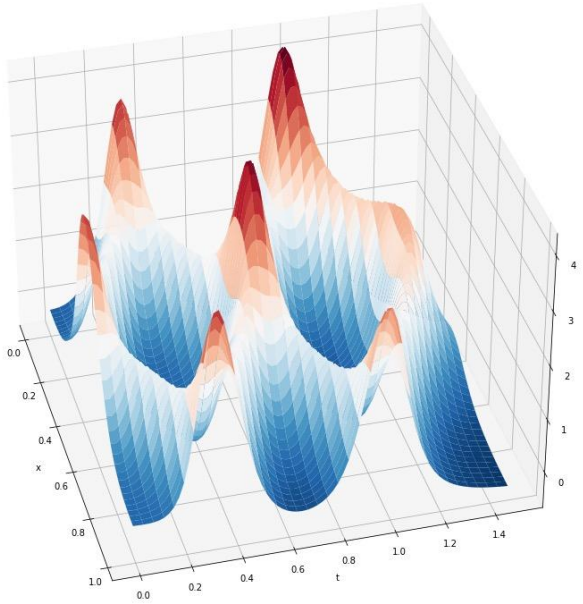


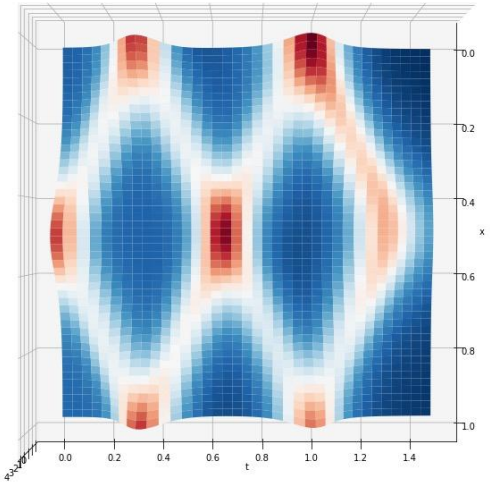
Prediction by neural network at c = 0.5m/s and t from 0s to 2s



Prediction v.s. Numerical Results RMSE Plot

Additional Findings





Prediction by neural network at c = 1.5m/s

Questions?