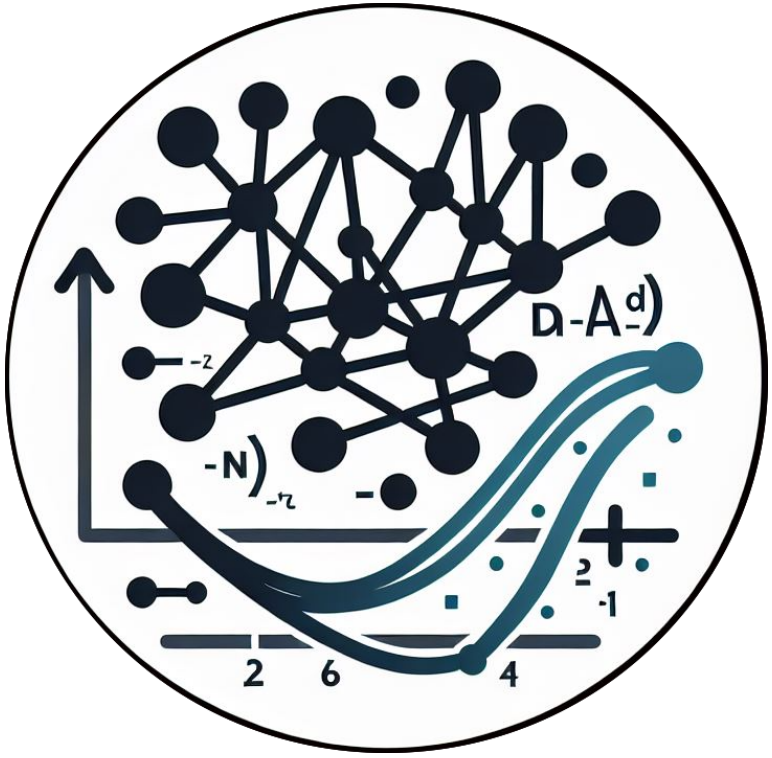
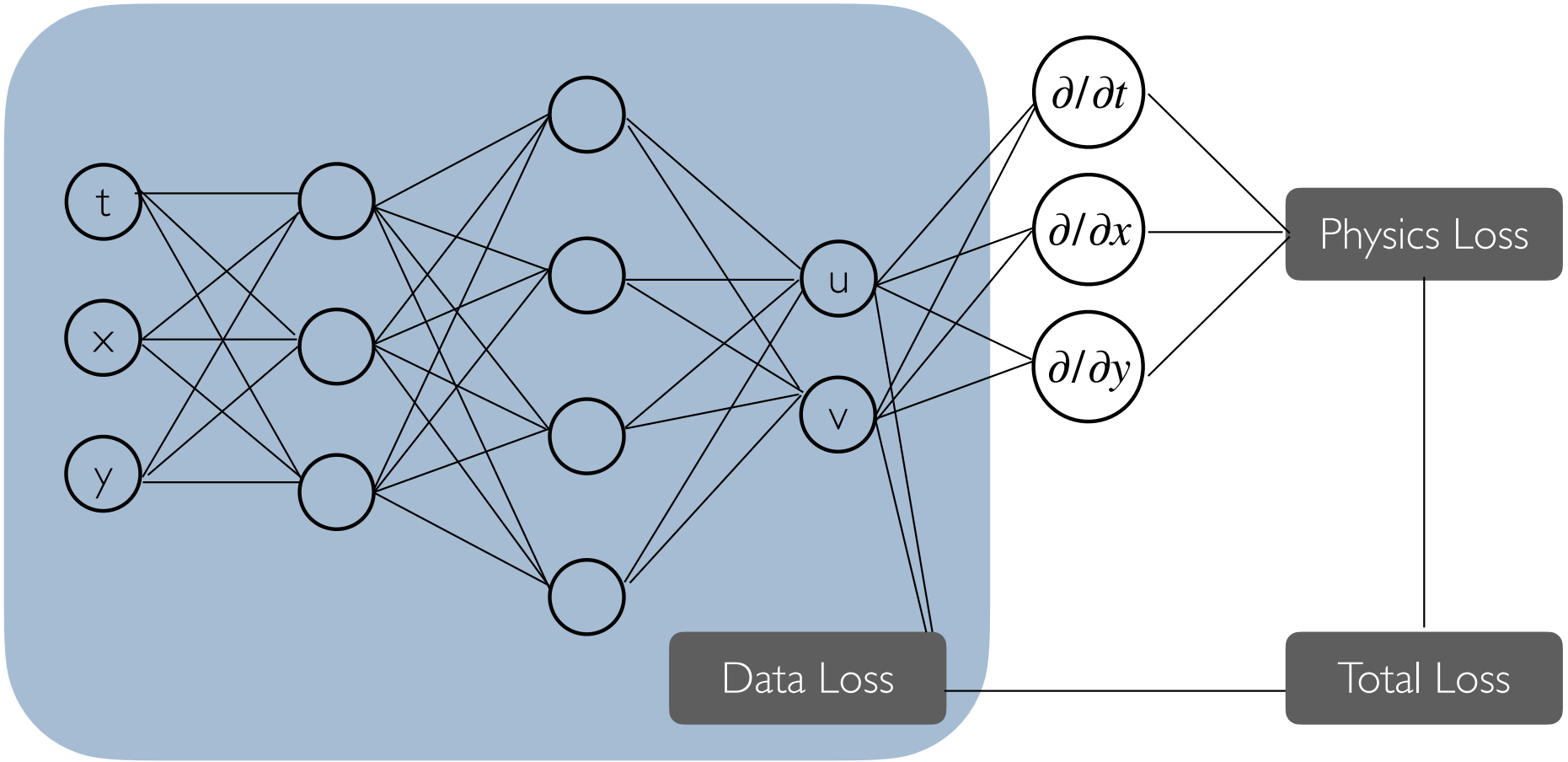
PINN Wrapup



Deep Learning for Engineers
Andrew Ning
aning@byu.edu

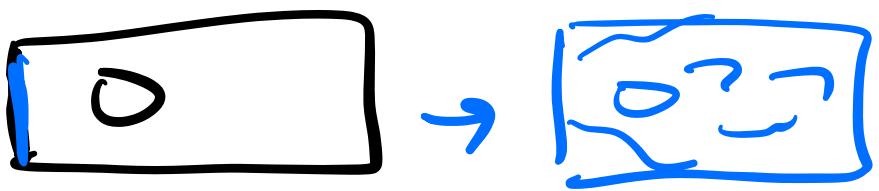
PINN



Harmonic Oscillator - inverse problem

$$L = \frac{1}{m}\sum_{i=1}^{m}(\hat{y}_i - y_i)^2 + \gamma\frac{1}{n}\sum_{j=1}^{n}\left(m\frac{\partial^2\hat{y}}{\partial t^2} + \mu\frac{\partial\hat{y}}{\partial t} + k\hat{y}\right)_j^2$$

learn these



```
torch.optim.Adam(model.parameters(), lr=1e-3)
```

```
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```

```
params = torch.nn.Parameter(torch.zeros(3,
requires_grad=True))

torch.optim.Adam(list(model.parameters()) +
[params], lr=1e-3)
```

```
t_data = torch.rand(40).reshape(-1, 1)

y_data = exact(t_data, params0) +
    0.04*torch.randn_like(t_data)
```

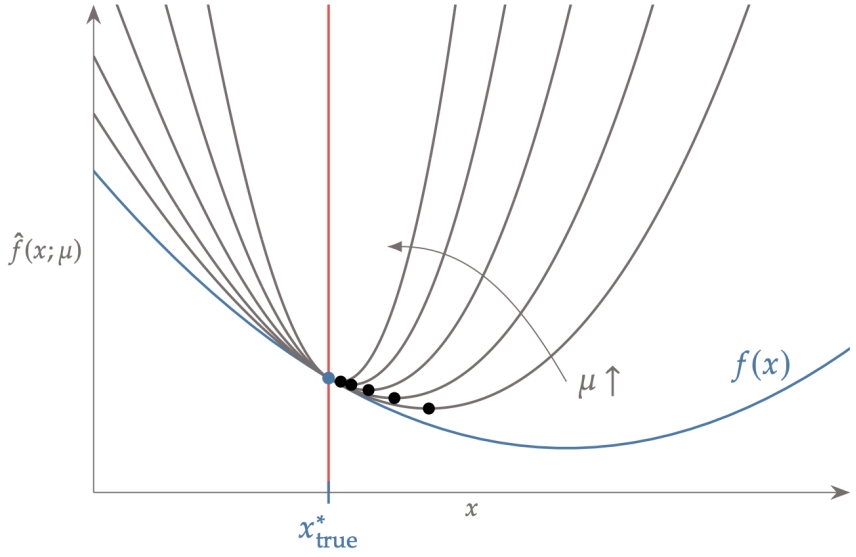
assume we just have data and physics equation

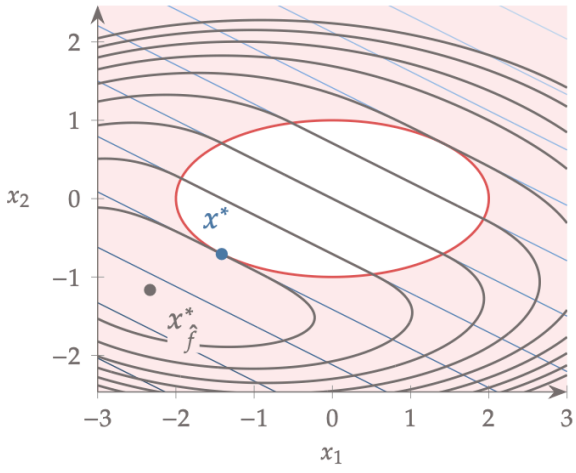
(we don't know boundary or initial conditions)

Challenges with PINNs

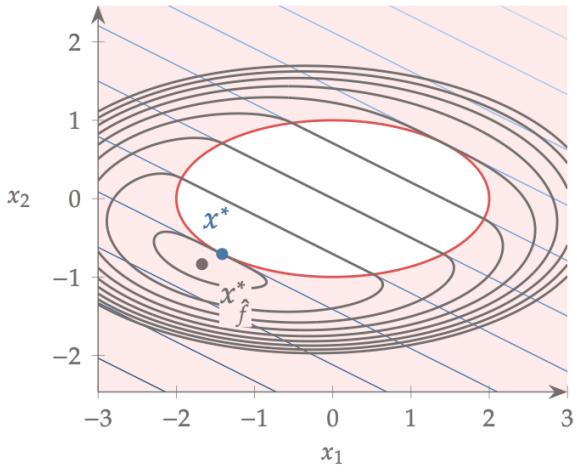
selecting weights appropriately

ill conditioning

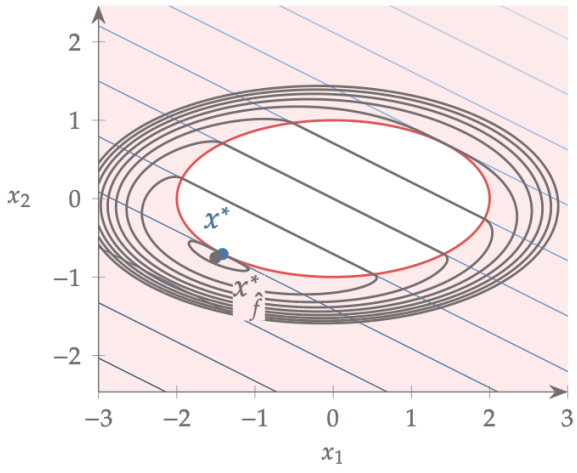




$\mu = 0.5$



$\mu = 3.0$



$\mu = 10.0$