

# Adversarial Uncertainty Quantification in Physics-Informed Neural Networks

Yibo Yang, Paris Perdikaris

University of Pennsylvania

26.05.2023

## The model: UQPINN

$$\text{UQPINN} = \text{GAN} + \text{PINN}$$

1. **UQPINN** : Uncertainty Quantification Physics-Informed Neural Network
2. **GAN** : Generative Adversarial Network
3. **PINN** : Physics-Informed Neural Network

"we will develop a flexible **variational inference** framework that will allow us to train such models directly from **noisy input/output data**, and predict outcomes of non-linear dynamical systems that are partially **observed** with quantified **uncertainty**"

– *Yibo Yang, Paris Perdikaris*

"we will develop a flexible **variational inference** framework that will allow us to train such models directly from **noisy input/output data**, and predict outcomes of non-linear dynamical systems that are partially **observed** with quantified **uncertainty**"

– *Yibo Yang, Paris Perdikaris*

Using adversarial approach to handle randomness in observations.

## Experiment Setup

### Author's Experiment Setup

**GPU** NVIDIA Tesla P100(16GB)

**DL framework** Tensorflow v1.10

**Formula**

1. pedagogical ODE
2. Burgers' equation
3. Darcy flow

**Model** UQPINN

## Experiment Setup

### Author's Experiment Setup

### My Experiment Setup

#### GPU

NVIDIA Tesla P100(16GB)

MX450(2GB)

#### DL framework

Tensorflow v1.10

Pytorch v1.9.0

#### Formula

1. pedagogical ODE
2. Burgers' equation
3. Darcy flow

1. pedagogical ODE
2. Burgers' equation
3. Darcy flow

#### Model

UQPINN

1. UQPINN
2. PINN

## Experiment Setup

### Author's Experiment Setup

### My Experiment Setup

#### GPU

NVIDIA Tesla P100(16GB)

MX450(2GB)

#### DL framework

Tensorflow v1.10

Pytorch v1.9.0

#### Formula

1. pedagogical ODE
2. Burgers' equation
3. Darcy flow

1. pedagogical ODE
2. Burgers' equation
3. Darcy flow

#### Model

UQPINN

1. UQPINN
2. PINN

parameters are set to be the same as the author's