ModelFLOWs APP

MODAL DECOMPOSITION

Pattern detection	Reconstruction	Prediction
HOSVD	Data Repairing	HODMD
HODMD	Superresolution	

DEEP LEARNING

Pattern detection	Reconstruction	Prediction
Autoencoders	Superrresolution	Full DL
		Hybrid

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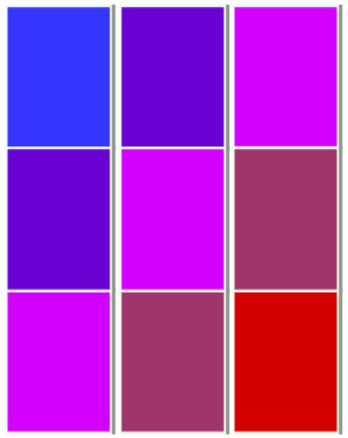
Motivation



Low resolution database

Many databases can come with a low resolution:

- Low capacity of simulation.
- Low quantity of sensors on an experiment.
- Low resolution when zooming and analysing a certain area.

Aim: Enhance the resolution of a database.

Methodology

Superresolution

INPUT

Low resolution database

Step 1

SVD:

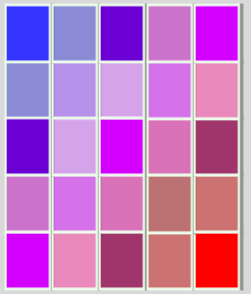
$$X = U\Sigma V^T$$

Apply SVD

Step 2

Interpolate modes

OUTPUT

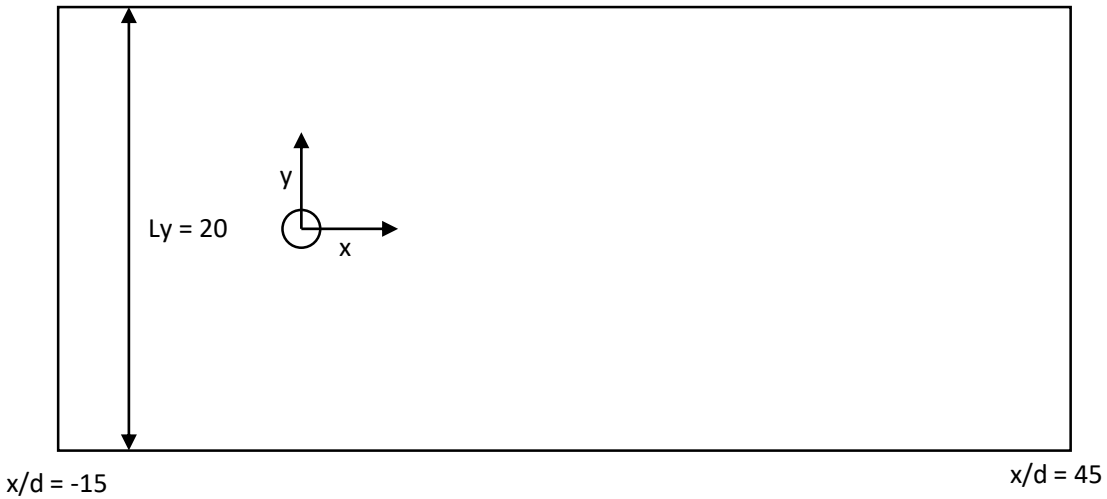


High resolution database

Database & Data preparation

Superresolution

2D Flow past a cylinder at Re = 100



Spatial dimensions

Snapshots Tensor = $\{N_v, N_x, N_y, N_t\}$

Variables

Temporal dimensions

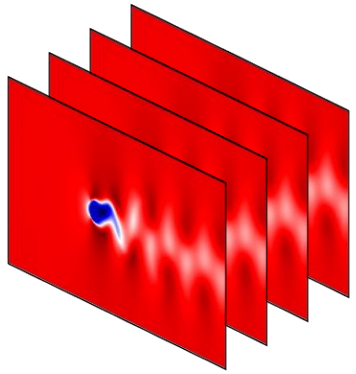
Database & Data preparation

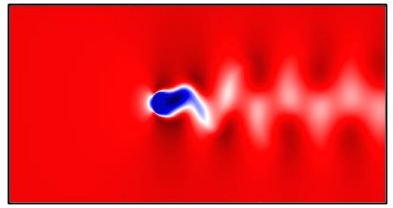
Superresolution

Snapshots Tensor = $\{N_v, N_x, N_y, N_t\}$

- $N_v = 2$
- $N_x = 500$
- $N_y = 500$
- $N_t = 100$

Image = 500 x 500



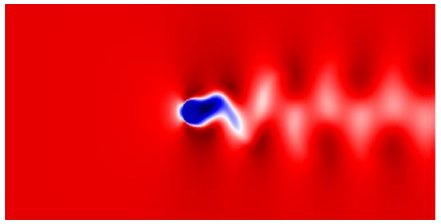


Calibration

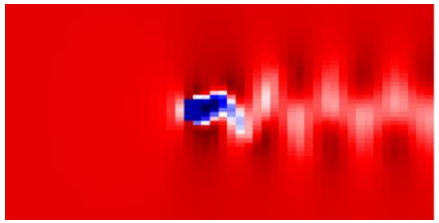
Enhancement parameter: The number of times the user wants to increase the resolution.

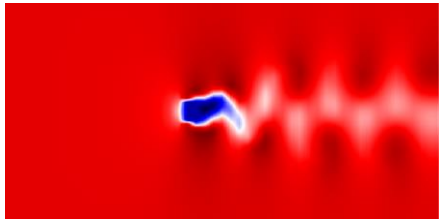
Value: 5x, 10x, 20x

Results



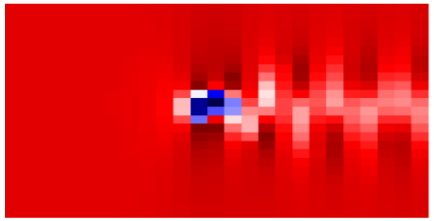
10x

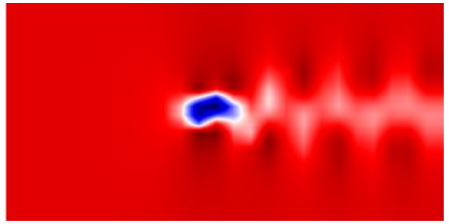




RRMSE: 1.3%

20x





RRMSE: 3.2%