ModelFLOWs APP

MODAL DECOMPOSITION

Pattern detection	Reconstruction	Prediction
HOSVD	Data Repairing	HODMD
HODMD	Superresolution	

DEEP LEARNING

Pattern detection	Reconstruction	Prediction
Autoencoders	Superresolution	Full DL
		Hybrid

ModelFLOWs APP

MODAL DECOMPOSITION

Pattern detection	Reconstruction	Prediction
HOSVD	Data Repairing	HODMD
HODMD	Superresolution	

DEEP LEARNING

Pattern detection	Reconstruction	Prediction
Autoencoders	Superresolution	**Full DL**
		Hybrid

Motivation

Full DL

Forecasting through deep learning and modal decomposition in two-phase concentric jets

León Mata[a], Rodrigo Abadía-Heredia[a,*], Manuel Lopez-Martin[a], José M. Pérez[a], Soledad Le Clainche[a]

[a]*ETSI Aeronáutica y del Espacio, Universidad Politécnica de Madrid, Plaza Cardenal Cisneros, 3, Madrid, 28040, Madrid, Spain*

https://doi.org/10.48550/arXiv.2212.12731

Forecasting through deep learning and modal decomposition in two-phase concentric jets

Motivation

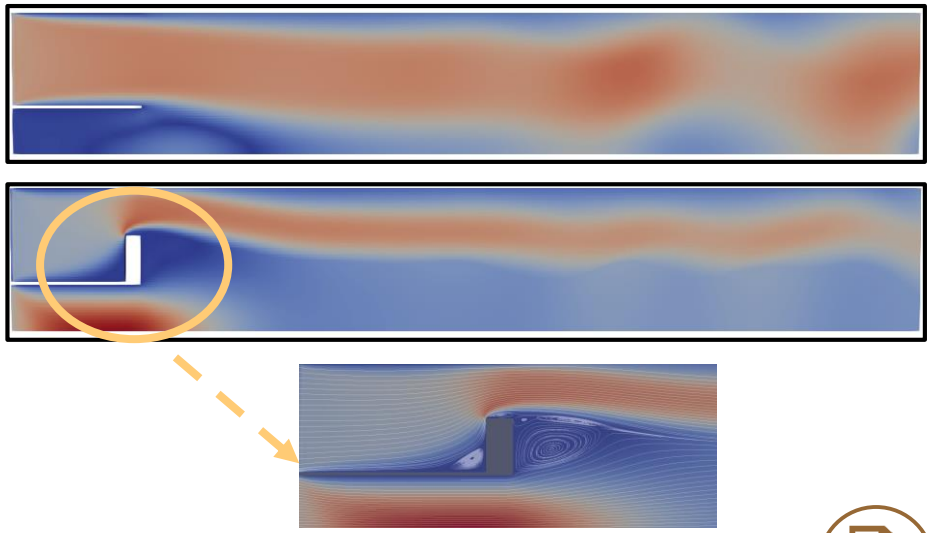
Full DL

Forecasting through deep learning and modal decomposition in two-phase concentric jets

León Mata[a], Rodrigo Abadía-Heredia[a,*], Manuel Lopez-Martin[a], José M. Pérez[a], Soledad Le Clainche[a]

[a]*ETSI Aeronáutica y del Espacio, Universidad Politécnica de Madrid, Plaza Cardenal Cisneros, 3, Madrid, 28040, Madrid, Spain*

https://doi.org/10.48550/arXiv.2212.12731



Forecasting through deep learning and modal decomposition in two-phase concentric jets

Motivation

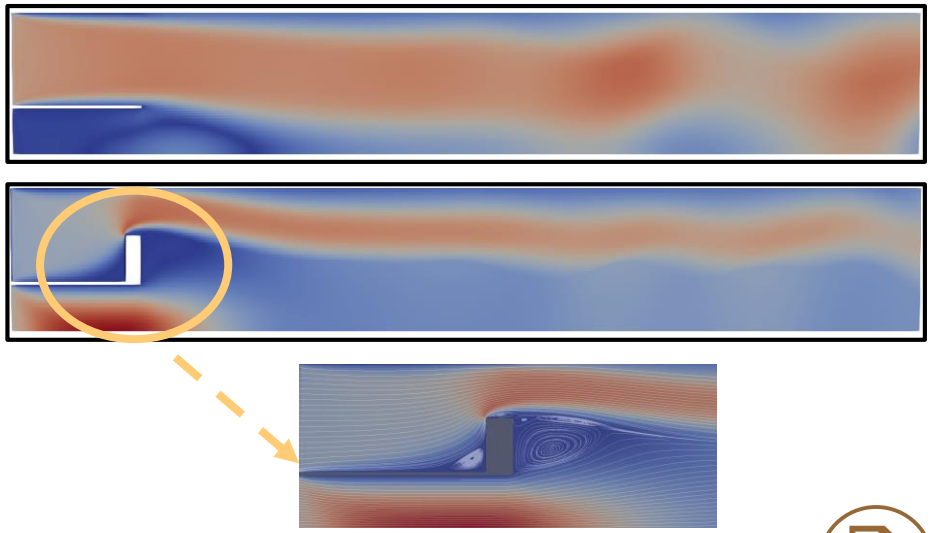
Full DL

Forecasting through deep learning and modal decomposition in two-phase concentric jets

León Mata[a], Rodrigo Abadía-Heredia[a,*], Manuel Lopez-Martin[a], José M. Pérez[a], Soledad Le Clainche[a]

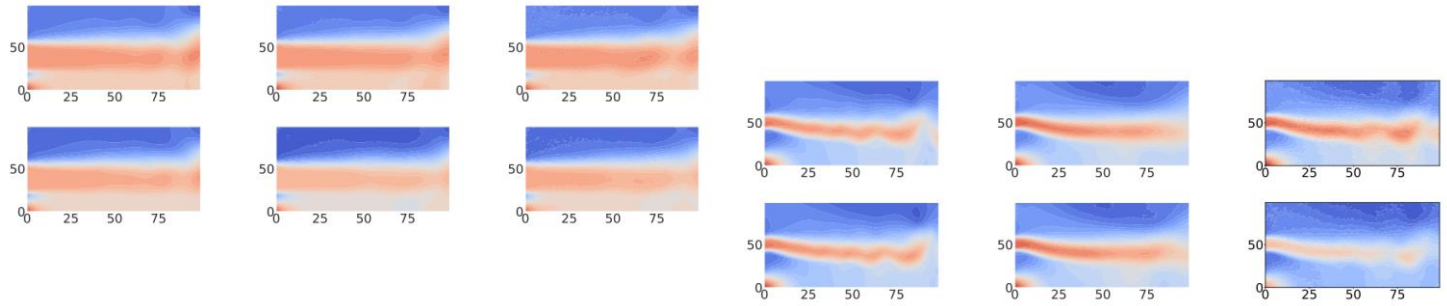
[a]*ETSI Aeronáutica y del Espacio, Universidad Politécnica de Madrid, Plaza Cardenal Cisneros, 3, Madrid, 28040, Madrid, Spain*

https://doi.org/10.48550/arXiv.2212.12731



Forecasting through deep learning and modal decomposition in two-phase concentric jets

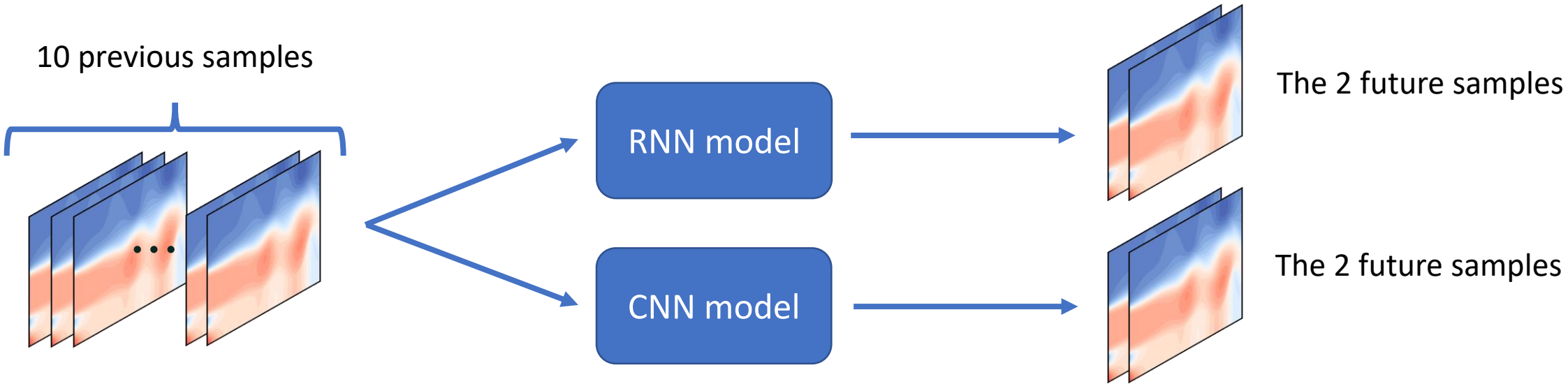
- In this work we proposed two forecasting models based entirely on deep learning.
- In contrast to the other published works (HybridDL) in this case the data sets are directly pass into the models with no previous preprocess like SVD.



ModelFLOWs

Methodology

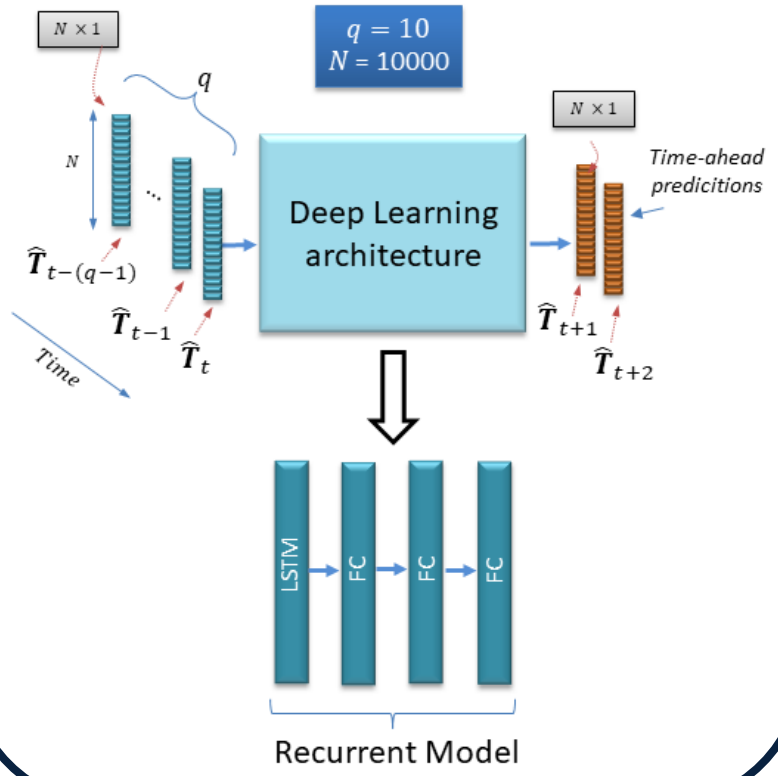
Full DL



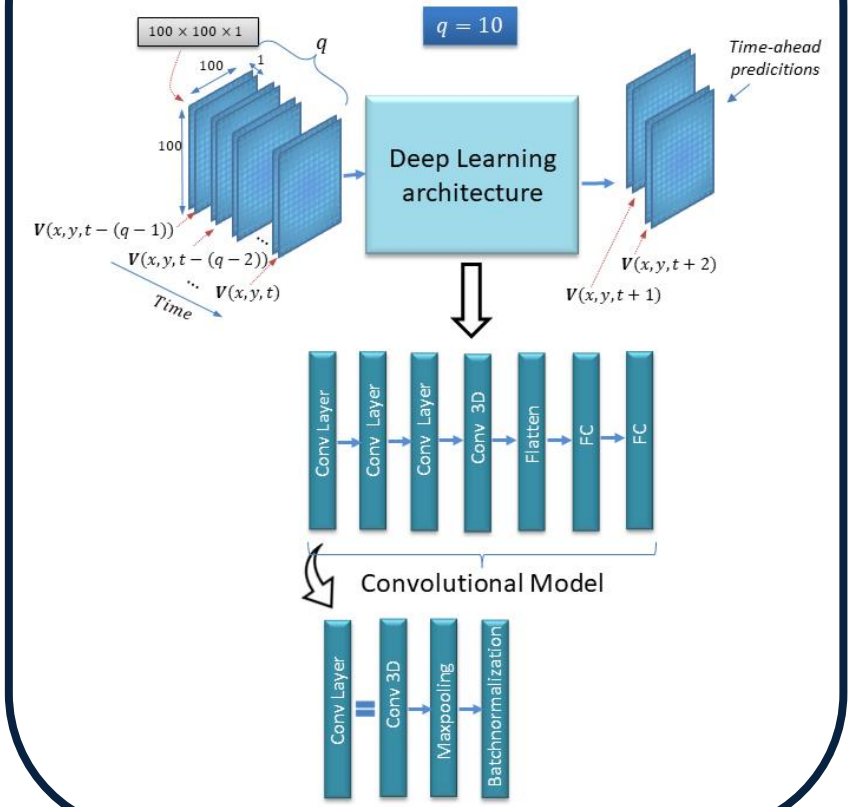
Methodology

Full DL

RNN Model



CNN Model



Database & Data preparation

Full DL

Both models RNN and CNN have been developed to receive as input two data sets:

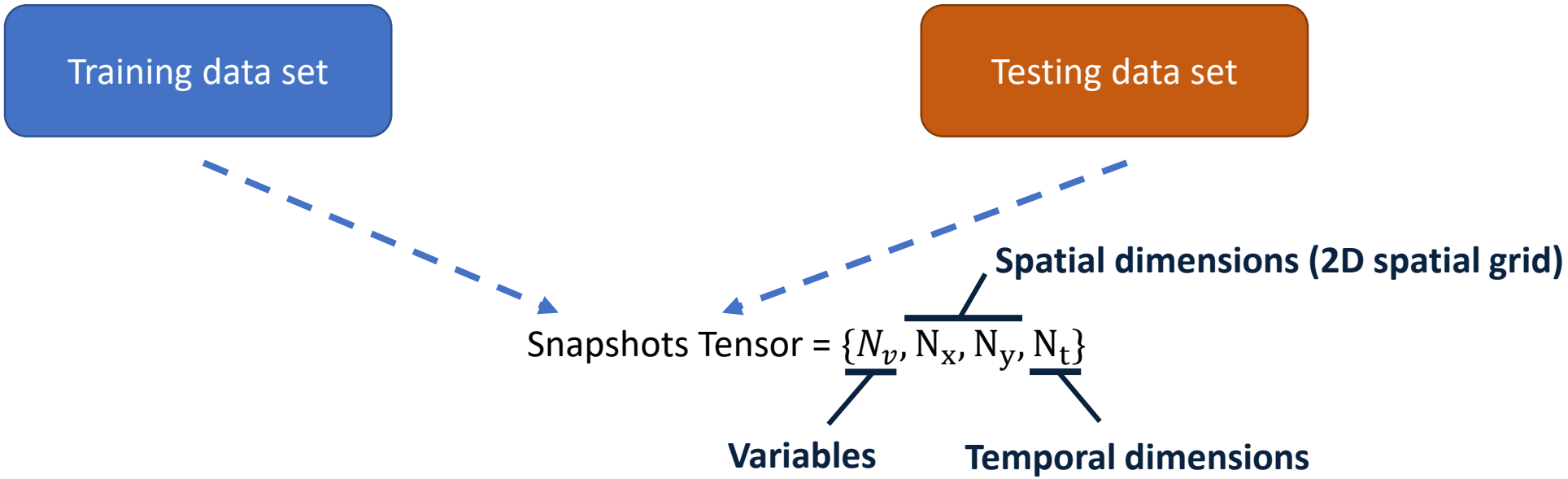
Training data set

Testing data set

Database & Data preparation

Full DL

Both models RNN and CNN have been developed to receive as input two data sets:



Database & Data preparation

Full DL

Spatial dimensions (2D spatial grid)

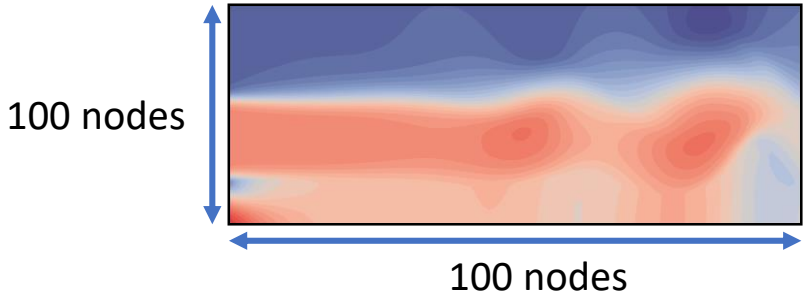
Snapshots Tensor = $\{N_v, \mathrm{N_x}, \mathrm{N_y}, \mathrm{N_t}\}$

Variables

Temporal dimensions

One of the data sets used in our paper:

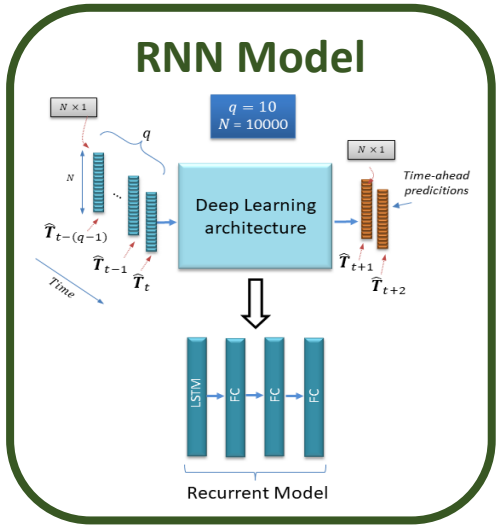
- Stream wise velocity -> 1 component
- X-axis discretized in 100 nodes.
- Y-axis discretized in 100 nodes.
- 351 snapshots

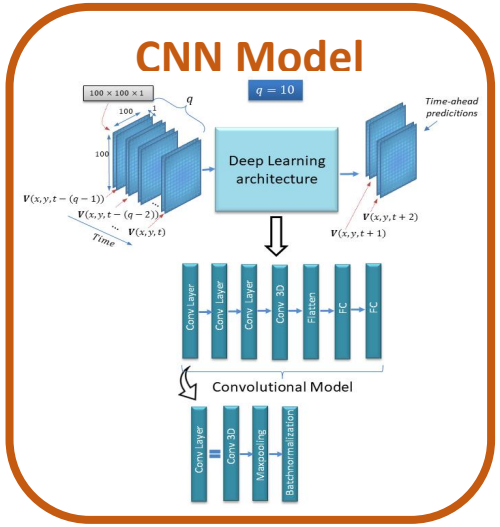


$\{N_v, \mathrm{N_x}, \mathrm{N_y}, \mathrm{N_t}\} \rightarrow \{1, 100, 100, 351\}$

Calibration

Full DL



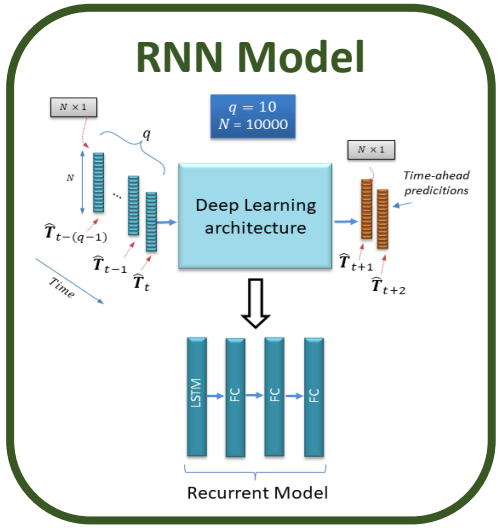


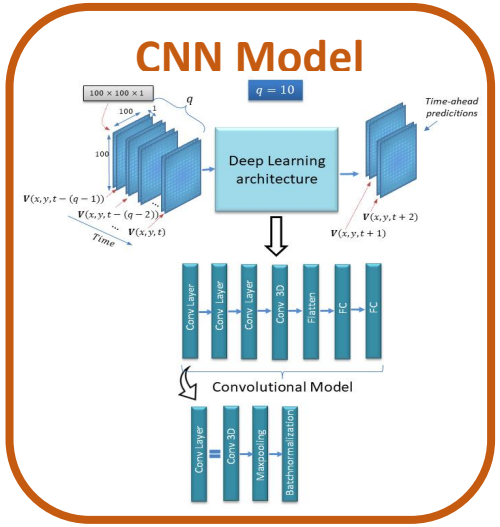
Hyperparameters		Restrictions	Recommendations
Training size	p_{train}	$\leq 80\ \%\ p$	$\leq 80\ \%$

$p \rightarrow$ Nº samples in training data set

Calibration

Full DL



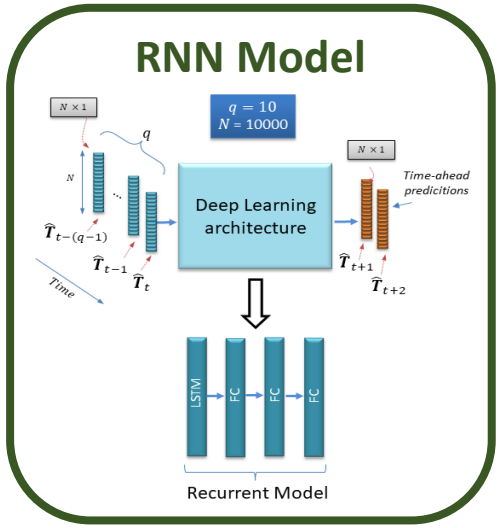


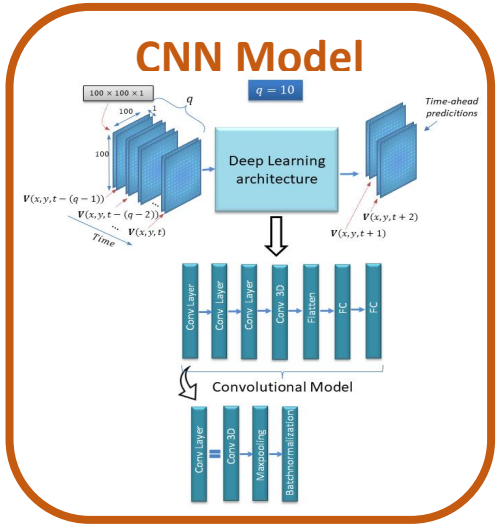
Hyperparameters		*Restrictions*	*Recommendations*
Training size	p_{train}	$\leq 80\ \%\ p$	$\leq 80\ \%$
Model to use		RNN Model CNN Model	CNN Model

$p \rightarrow$ Nº samples in training data set

Calibration

Full DL





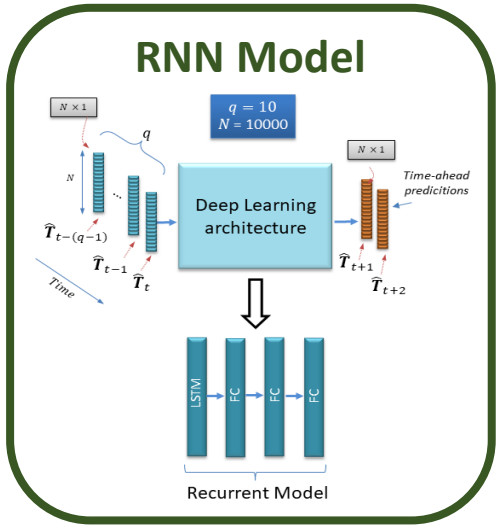
Hyperparameters		*Restrictions*	*Recommendations*
Training size	p_{train}	$\leq 80\ \%\ p$	$\leq 80\ \%$
Model to use		RNN Model CNN Model	CNN Model
Batch size	N_{batch}	$< p_{train} - 10$	$32, 64, 128, \ldots$

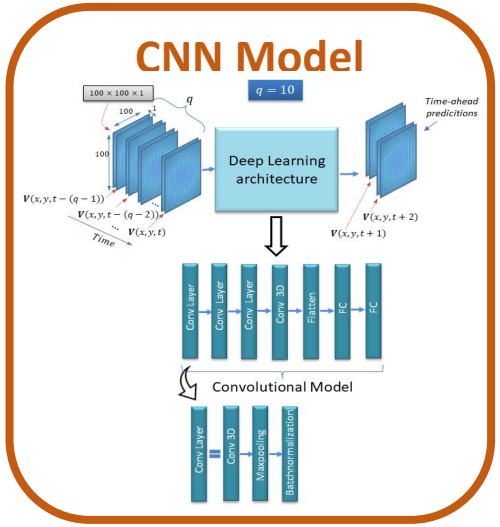
$p \rightarrow$ Nº samples in training data set

ModelFLOWs

Calibration

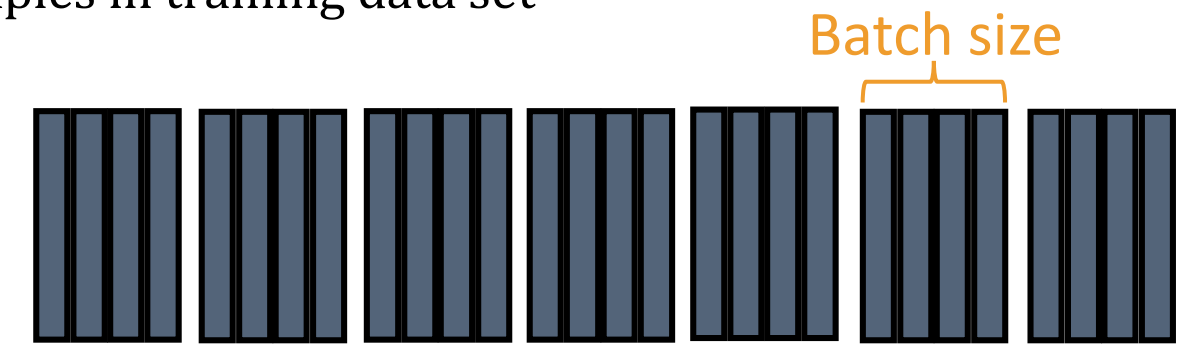
Full DL





Hyperparameters		*Restrictions*	*Recommendations*
Training size	p_{train}	$\leq 80\ \%\ p$	$\leq 80\ \%$
Model to use		RNN Model CNN Model	CNN Model
Batch size	N_{batch}	$< p_{train} - 10$	$32, 64, 128, \ldots$

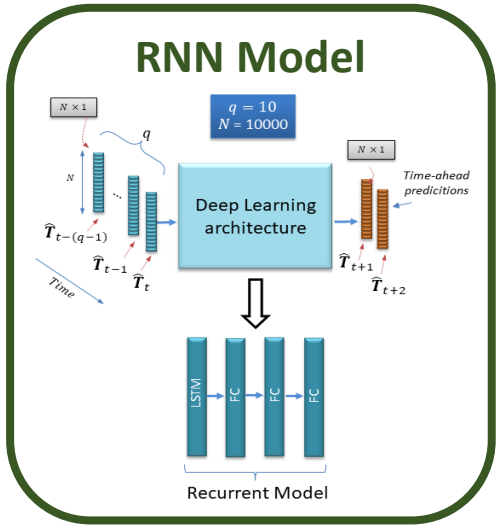
$p \rightarrow$ Nº samples in training data set

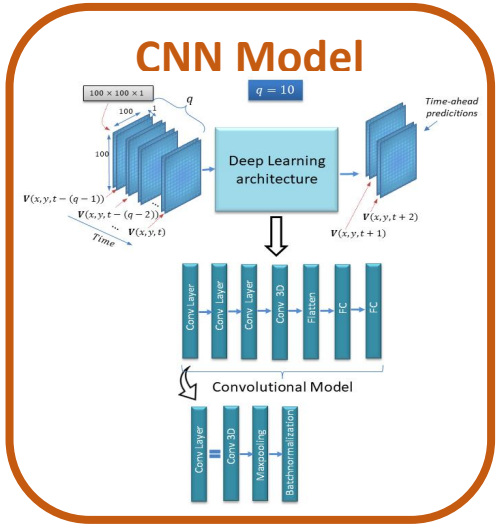


ModelFLOWs

Calibration

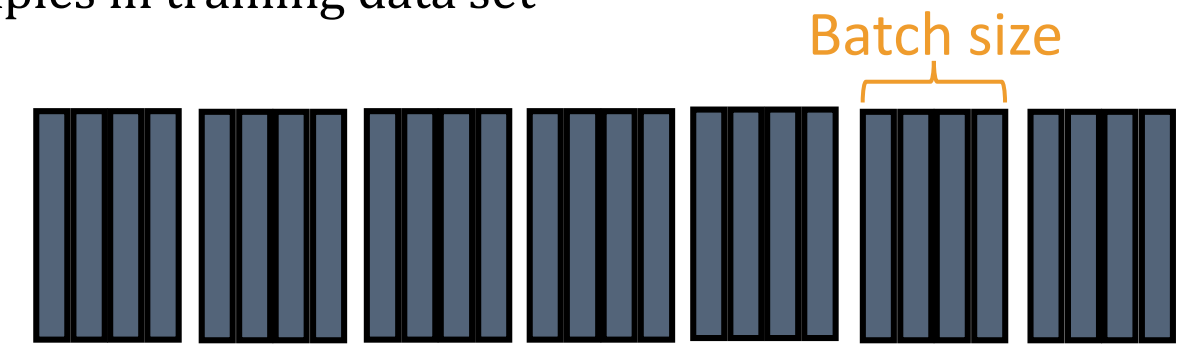
Full DL





Hyperparameters		*Restrictions*	*Recommendations*
Training size	p_{train}	$\leq 80\ \%\ p$	$\leq 80\ \%$
Model to use		RNN Model CNN Model	CNN Model
Batch size	N_{batch}	$< p_{train} - 10$	$32, 64, 128, \ldots$
Epochs number	N_{epoch}	> 0	$100, 200, 500, \ldots$

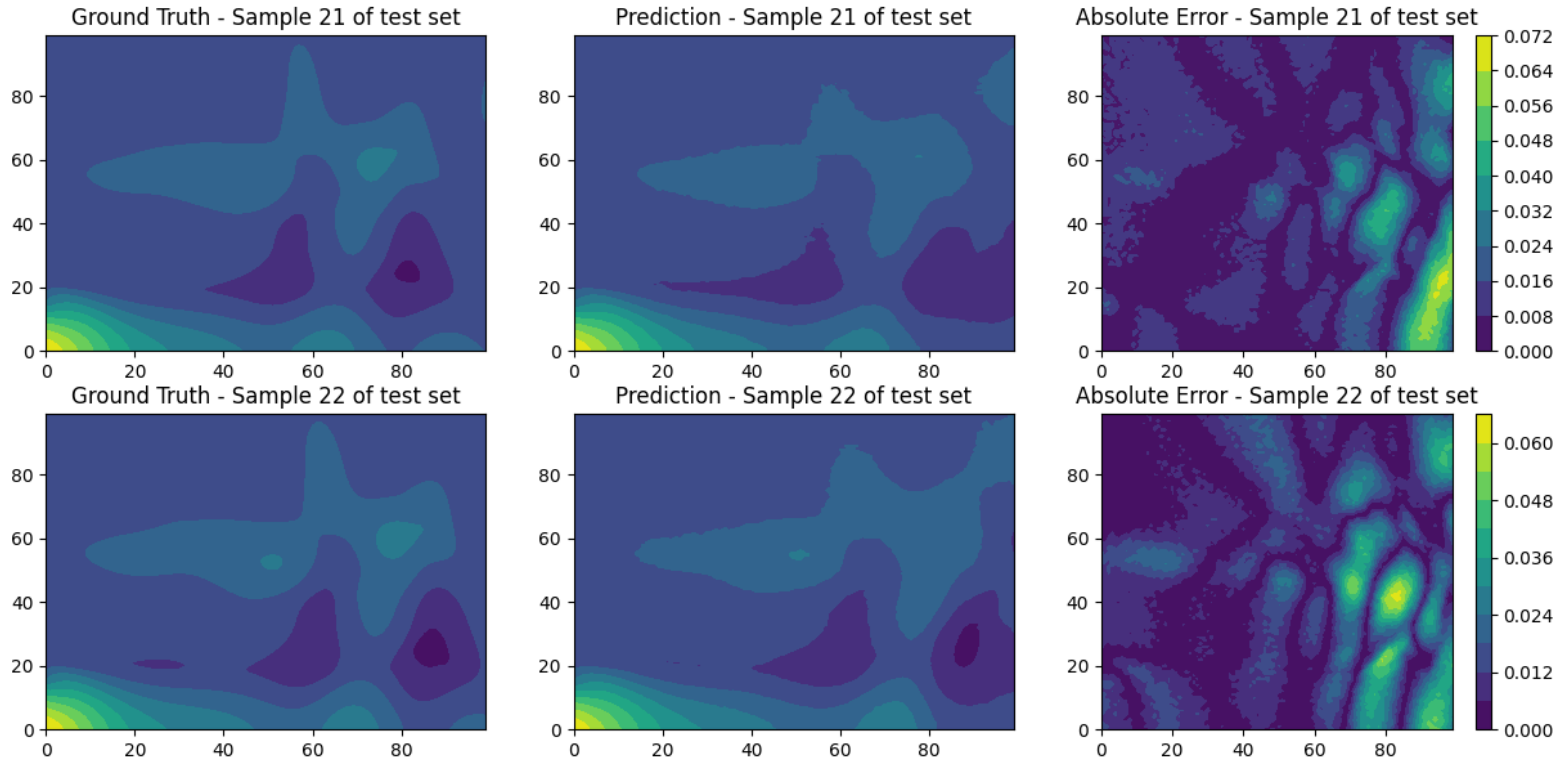
$p \rightarrow$ Nº samples in training data set



Results

Full DL

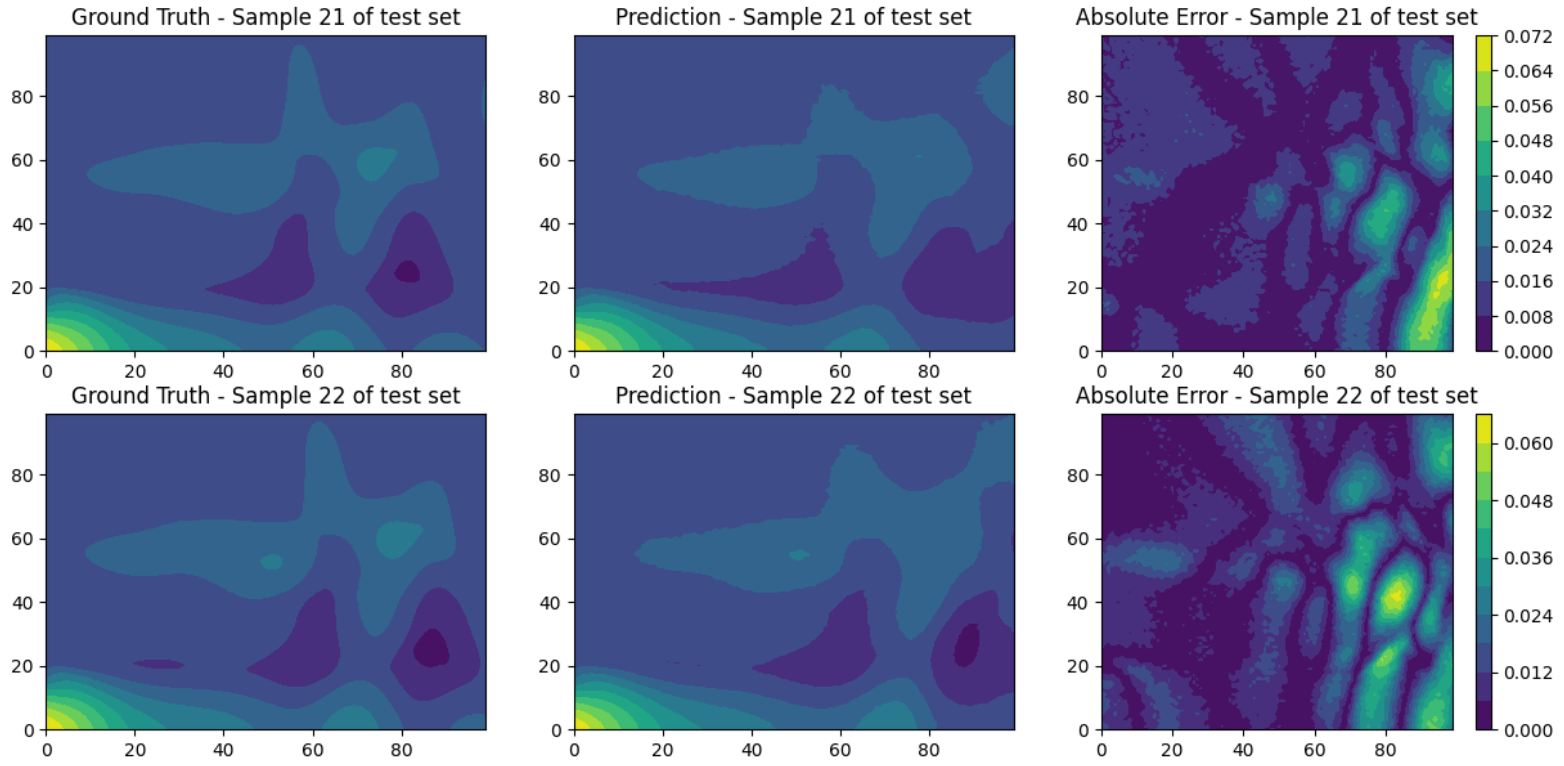
Both models return two data sets containing the two predictions that are obtained from the testing data set. It also allows to plot a qualitative comparison of the predictions and target.



Results

Full DL

Both models return two data sets containing the two predictions that are obtained from the testing data set. It also allows to plot a qualitative comparison of the predictions and target.



Click here for more information


Thanks for
watching! Visit us
on:
http://modelflows.e
s