

# Table of Content

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	The Kolmogorov equation . . . . .	1
1.1.1	Brief historical review . . . . .	2
1.1.2	Finite-dimensional non-local framework . . . . .	3
1.1.3	Hilbert local framework . . . . .	4
1.2	Deep Learning . . . . .	5
1.2.1	Brief review of the literature . . . . .	5
1.3	Thesis Layout . . . . .	7
<b>2</b>	<b>Mathematical Preliminaries</b>	<b>8</b>
2.1	Notation . . . . .	8
2.2	Hilbert spaces and Linear Operators . . . . .	9
2.3	Assumptions . . . . .	11
2.4	Stochastic Calculus . . . . .	13
2.4.1	A review on Stochastic processes . . . . .	13
2.4.2	Stochastic system in finite-dimensional non-local framework . . . . .	17
2.4.3	Stochastic system in Hilbert framework . . . . .	19
<b>3</b>	<b>Universal Approximation Theorems and Deep-H-Onets</b>	<b>28</b>
3.1	Finite Dimensional Neural Networks . . . . .	28
3.2	Infinite Dimensional Neural Networks: Hilbert-valued DeepOnets . . . . .	34

<b>4 Non-local Kolmogorov equation on finite dimensions</b>	<b>41</b>
4.1 Numerical scheme . . . . .	41
4.2 Previous Definitions and Results . . . . .	43
4.3 Main Result . . . . .	46
4.3.1 Optimization step of the algorithm . . . . .	60
<b>5 Kolmogorov equation posed on a Hilbert space</b>	<b>62</b>
5.1 Functional Numerical Scheme . . . . .	62
5.2 Previous Definitions and Results . . . . .	64
5.3 Main Result . . . . .	68
<b>Bibliography</b>	<b>83</b>