3 Days in order, Sousse, Tunisia

8-10 juin 2023

Temps	Jeudi 8 juin 2023		Vendredi 9 juin 2023		Samedi 10 juin 2023	
De 9H à 10H30	**Youssef Azouzi**	"Introduction to Nets"	**Youssef Azouzi**	"Introduction to Nets"	**Youssef Azouzi**	"Introduction to Nets"
De 10H30 à 10H50	**Pause café**		**Pause café**		**Pause café**	
De 10H50 à 12H 20	**Jamel Jaber**	"Banach Lattices and Applications "	**Slim Omri**	"Principes d'incertitude en termes de support"	**Jamel Jaber**	"Banach Lattices and Applications"
De 12H20 à 14H00	**Déjeuner**		**Déjeuner**		**Cloture**	
De 14H00 à 14H45	**Abdallah Ben Abdallah**	"Generative Models: basis and recent advances"	**Marwa Masmoudi**	"An overview on some topics in Ergodic theory"	**Déjeuner**	
De 14H55 à 15H25	**Houssem Sellami**	"Stochastic Interpolant for Generative Models"	**Hfaiedh Mohamed**	"Eberlein-Šmulian theorem"		
De 15H35 à 15H55	**Pause café**		**Pause café**			
De 15H55 à 16H25	**Naoufel Salhi**	"Le temps local et le temps local d'intersection de certains processus stochastiques."	**Wassim Dhifaoui**	"Théorème de Kakutani et applications"		
De 16H35 à 17H05	**Faouzi Thabet**	"Trajectories of Quadratic Differentials on the Riemann Sphere and Applications"	**Mariem El Mansour**	"A new approach to solve the problem of super-hedging European or Asian option under price uncertainty. "		
De 17h15 à 17h45	**Haithem Lamouchi**	"Dunford-Pettis theorem : a journey between measure and functional analysis"	**Marwa Troudi**	"Arens regularity of the Banach lattice algebra "		

Generative Models: basis and recent advances

Abdallah Ben Abdallah

Abstract: Generative models are a class of machine learning algorithms that are designed to learn patterns and relationships in data. These models can be used for a variety of tasks, including image generation, text generation, speech synthesis, drug design, and robotics. In this talk, we will provide a brief overview of the basics of generative models, including the types of generative models and the training algorithms used to learn them. We will also discuss some recent advances in the field, including the use of deep learning techniques and the development of more sophisticated generative models.

Théorème de Kakutani et applications

Wassim Dhifaoui

Abstract: Cet exposé met l'accent sur le théorème de Kakutani et ses applications. Dans la première partie, nous examinons les concepts clés tels que l'AM Space, l'AL Space, la topologie faible étoile et les points extrémaux, qui jouent un rôle crucial dans la preuve du théorème de Kakutani.

Dans la deuxième partie, nous explorons quelques applications pratiques du théorème de Kakutani.

Cet exposé offre une compréhension approfondie du théorème de Kakutani et met en évidence son potentiel d'application dans différents domaines.

A new approach to solve the problem of super-hedging European or Asian option under price uncertainty

Mariem El Mansour

Abstract: As observed in practice, the executed value of an asset may depend on the order sent by the trader and, also, on the quantities available in the order book. Among the possible causes of the well-known slippage phenomenon, delays in the execution of the orders, liquidity disorders, market impacts, or transaction costs may influence the executed value. An approach to overcome this difficulty is to assume that we do not know in advance the traded prices. In that case, the order that the trader sends is a mapping that associates to each possible price available in the market a quantity to sell or buy. This is exactly what we generally observe in practice, in a presence of an order book for example, since there is no single price. We provide a numerical procedure to compute the infimum price under a weak no-arbitrage condition, the so-called AIP condition, under which the prices of any non negative European options are non negative. This condition is weaker than the existence of a risk-neutral martingale measure but it is sufficient to numerically solve the super-hedging problem.

Eberlein-Šmulian theorem

Mohamed Hfaiedh

Abstract:

Dunford-Pettis theorem : a journey between measure and functional analysis

Haithem Lamouchi

Abstract: Evaluating compactness though appreciated can be delicate to prove in generalI case and can be more elusive in weak* topology. Ascertain that a set is relatively weakly compact can be done through topological techniques; nonetheless Dunford-Pettis Theorem builds a bridge between this topological property and a measure theory property. I will give a proof of Dunford-Pettis Theorem while trying to give an overview of the notions involved in the proof. I will begin by the uniform integrability and some of its basic properties then a proof of Vitali-Hahn-Saks Theorem by considering the Nikodym metric space and finally I will display a comprehensive proof of the main theorem.

An overview on some topics in Ergodic theory

Marwa Masmoudi

Abstract: In this talk, we will explore two key topics in ergodic theory. Firstly, we will treat the concept of ergodicity and provide various characterizations to enhance our understanding. Additionally, we will introduce the notion of recurrence and examine significant results associated with it. Our discussion will specifically emphasize the Kac formula, Poincaré Recurrence theorem, and the Kakutani Rokhlin lemma. As an application, we will prove that every aperiodic transformation can be approximated by a periodic one.

Le temps local et le temps local d'intersection de certains processus stochastiques.

Naoufel Salhi

Abstract: Je commence dans cet exposé par présenter les notions de temps local et de temps local d'intersection ainsi que quelques résultats associés au mouvement Brownien. Je présente ensuite certains résultats sur le temps local et le temps local d'intersection d'une classe particulière de processus stochastiques.

Stochastic Interpolant for Generative Models

Houssem Sellami

Abstract: Generative models are a powerful tool for learning patterns and relationships in data, but they can be computationally expensive and may not be able to capture complex relationships in the data. In this talk, we will present a new technique for improving the efficiency and performance of generative models with theoretical guarantees. The technique is based on the use of stochastic interpolants, which are functions that can approximate the data points in a high-dimensional space. The method uses ODE flow in the generative models instead of the SDE flow used by the recent diffusion model. Throughout the talk, we will focus on the theoretical and practical aspects of the technique, and discuss its potential applications in various fields such as drug design.

Bibliography : 1. Michael S. Albergo, Eric Vanden-Eijnden, Building Normalizing Flows with Stochastic Interpolants ICLR (2023)
2. MS Albergo, NM Boffi, E Vanden-Eijnden, Stochastic interpolants: A unifying framework for flows and diffusions (2023).

Trajectories of Quadratic Differentials on the Riemann Sphere and Applications

Faouzi Thabet

Abstract: In this lecture, we give some basics of the theory of Quadratic Differentials on the Riemann Sphere. The focus will be on the investigation of the existence of finite critical trajectories and the description of the critical graph. Three applications will be treated : Polynomial lemniscates. Existence of a solution interpreted as the Cauchy transform of a signed measure of a particular algebraic quadratic equation as the form : $p(z)\mathcal{C}^2(z)+q(z)\mathcal{C}(z)+r=0$, for some polynomials p, q and r; as an example, we study the large-degree analysis of the behavior of the generalized Laguerre polynomials $L_n^{(\alpha)}$ when the parameters are complex and depend on the degree n linearly. Discussion of solution of Schrödinger equation with polynomial potential.

Arens regularity of the Banach lattice algebra

Marwa Troudi

Abstract: Let A be a Banach lattice algebra, with A' and A" being the dual and the bidual of A, respectively. Arens has defined two natural extensions of the product on A to A". Under either Arens product, A" becomes a Banach lattice algebra. We investigate the Arens regularity of the Banach lattice algebra, which refers to the condition where both products coincide.

We examine an important example presented by Arens in "The adjoint of bilinear operation" to demonstrate that this assertion is not always true. Specifically, we demonstrate that A is Arens regular if and only if it does not contain a copy of ℓ^1. However, we provide a characterization of ℓ^1 in this context.