

Programme du lundi 08 Juin

Lundi 08 Juin : Après-midi

11h45 - 13h00	Déjeuner	Lieu : Salle L217 : Buffet
13h00 - 13h30	Accueil - Café	Salle L217
13h30 - 14h15	Yacouba Boubacar	Modélisations des PVAR avec erreurs dépendantes
14h15 - 15h00	Arnaud Descours	Mean-field analysis of the training dynamics of two-layer neural networks
15h00 - 15h45	Olivier Wintenberger	Stochastic Rainfall Occurrence Generator with Long Periods of Drought
15h45 - 16h15	Pause café	Salle L217
16h15 - 17h00	Mokhtar Alaya	A Patch-Based Transformer focusing on Patch-Wise Reconstruction Error for Time Series Anomaly Detection
17h00 - 17h45	Hadi Ismail Fawaz	Deep Learning for Time Series Analysis with Application on Human Rehabilitation
17h45 - 18h15	Majda Hamomi	Estimation robuste et adaptative par réseaux de neurones profonds pour la classification : Application au scoring bancaire
19h45	Dîner du workshop	Restaurant La Loco

Programme du mardi 09 Juin

Mardi 09 Juin : Matin

08h30 - 9h15	Café	Salle L217
9h15 - 10h00	Lionel Truquet	On the Transfer of Mixing Rates for Markov Chains in Random Environments, with Applications to Time Series Analysis and Machine Learning
10h00 - 10h45	Branda Goncalves	Un réseau neuronal interactif avec inhibition : analyse théorique et simulation parfaite
10h45 - 11h30	Azadeh Khaleghi	Estimating mixing coefficients from dependent sample paths with connections to sequential decision making
11h30 - 13h30	Déjeuner	Bistrot de la Galerie

Mardi 09 Juin : Après-midi

13h30 - 14h15	Jean-Marc Bardet	Oracle Bounds for out-of-sample risk in time series with exogenous variables
14h15 - 15h00	Jordan Patracone	Conformal Online learning of deep Koopman linear embedding
15h00 - 15h40	Modou Wade	Deep regression learning from dependent observations with minimum error entropy principle
15h40 - 16h20	Ehud Ockegna	Deep nonparametric regression under covariate shift

Résumés des présentations

1. Mokhtar Alaya (Université de technologie de Compiègne)

Titre: A Patch-Based Transformer focusing on Patch-Wise Reconstruction Error for Time Series Anomaly Detection

Résumé: Time series anomaly detection (TSAD) involves automatically identifying observations that deviate from normal temporal patterns. This capability is becoming increasingly important in modern cyber-physical systems, the industrial Internet of Things (IoT) and IT monitoring, where the early detection of irregular behaviours has a direct impact on safety, reliability and cost. However, existing deep TSAD methods predominantly follow forecasting-based strategies, whereby a model is trained to predict future values and anomalies are inferred from significant prediction errors. In this talk, we introduce PatchTrAD: a patch-based Transformer for TSAD that works by reconstructing short temporal segments rather than forecasting future points. It splits each multivariate window into overlapping patches, encodes these with a lightweight Transformer and then reconstructs them. The anomaly score at a given time step is the reconstruction error of the final patch, which contains the most recent observation. This patch-wise reconstruction design provides accurate anomaly localisation while keeping the number of tokens small, offering a favourable balance between detection performance and inference speed compared to previous Transformer- and patch-based TSAD methods.

2. Jean-Marc Bardet (Université Paris 1)

Titre: Oracle Bounds for out-of-sample risk in time series with exogenous variables

Résumé: We consider the selection of models for time series with exogenous variables. For this purpose, we study the estimated one-step prediction risk out-of-sample method. In the econometrics literature, “out-of-sample” is the primary method to select a suitable time series model. This method consists of estimating models on a learning set and picking up the model with minimal empirical error on a validation set of future observations. In this paper, under suitable assumptions, we state generalization bounds and oracle inequalities for such a method; in particular, we show that

the “out-of-sample” selection method selects a model with a risk close to the optimal one for risk measures and models widely used in time series.

3. **Yacouba Boubacar** (Université Polytechnique Hauts-de-France)

Titre: Modélisations des PVAR avec erreurs dépendantes

Résumé: Nous nous intéressons à l’analyse statistique des modèles PVAR (periodic VAR) pour des processus qui peuvent avoir des dynamiques non linéaires très générales (c’est-à-dire PVAR faibles). Nous établissons la normalité asymptotique des estimateurs des moindres carrés pour les modèles PVAR contraints et non contraints sans faire l’hypothèse d’indépendance sur le bruit, contrairement à ce qui est fait habituellement pour l’inférence de ces modèles. Relâcher cette hypothèse d’indépendance permet aux modèles PVAR faibles de couvrir une large classe de processus non linéaires. Nous faisons des hypothèses essentielles d’ergodicité et de mélange afin d’établir la convergence forte et la normalité asymptotique des estimateurs proposés. Nous montrons que, pour les estimations des paramètres de modèles PVAR faibles, la matrice de variance asymptotique a une forme ”sandwich”. Nous avons également proposé des estimateurs des matrices de variances asymptotiques obtenues. Nous proposons également des procédures de validation de ses modèles PVAR faibles.

4. **Arnaud Descours** (Université Claude Bernard Lyon 1, ISFA)

Titre: Mean-field analysis of the training dynamics of two-layer neural networks

Résumé: Training neural networks via stochastic gradient descent (SGD) amounts to solving a complex, non-convex optimization problem. Inspired by statistical mechanics, the mean-field approach provides a macroscopic description of the training dynamics, which can be formulated as a convex optimization problem. In this talk, I will explain how to rigorously derive the macroscopic (mean-field) description from the microscopic dynamics given by the SGD updates. More precisely, I will establish the mean-field limit (a law of large numbers) and study the fluctuations around this limit (a central limit theorem). If time allows, I will present similar results in the Bayesian framework.

5. **Hadi Ismail Fawaz** (Université de Haute-Alsace)

Titre: Deep Learning for Time Series Analysis with Application on Human Rehabilitation

Résumé: Time series data underpin critical applications across domains such as healthcare, energy, telecommunications, and finance. Their analysis aims to uncover patterns, trends, and latent structures from temporally dependent observations. Core tasks include classification of behaviors, prediction of future outcomes, clustering of similar dynamics, and the generation of synthetic data when acquisition is costly. In this talk, we will specifically explore key learning tasks such as time series classification, extrinsic regression, prototyping, and data augmentation. These perspectives provide complementary ways to understand temporal data: from recognizing patterns and predicting external variables, to summarizing typical behaviors and enriching datasets in low-resource scenarios. While traditional approaches rely on distance measures and handcrafted temporal features, recent advances in deep learning are reshaping the field. We will place a particular emphasis on frugality designing models that are not only accurate, but also efficient, computationally lightweight, and robust in constrained settings. We will conclude by illustrating these ideas through applications in human rehabilitation, focusing on the assessment and monitoring of a patient's ability to correctly perform rehabilitation exercises in real-world medical contexts.

6. **Branda Goncalves** (Université Paris-Est Créteil)

Titre: Un réseau neuronal interactif avec inhibition : analyse théorique et simulation parfaite

Résumé: Le fonctionnement d'un réseau de neurones repose sur le fait que les neurones s'envoient des décharges les uns aux autres, plus précisément, les neurones présynaptiques envoient des décharges à leurs partenaires postsynaptiques. J' étudie ici un modèle de réseau de neurones purement inhibiteur où les neurones sont représentés par leur état d'inhibition. Dans une première partie, je donnerai une condition locale de Doeblin qui implique l'existence d'une mesure de probabilité invariante pour le processus. Ensuite, j'étends le modèle au cas où les neurones sont indexés par Z et je

construis un algorithme de simulation parfaite pour montrer l'ergodicité du processus sous certaines conditions. Si le temps me le permet, je vous présenterai une application de la simulation parfaite avec les processus de Hawkes.

7. **Majda Hamomi** (Université Jean Monnet, Premista)

Titre: Estimation robuste et adaptative par réseaux de neurones profonds pour la classification : Application au scoring bancaire

Résumé: On considérera un cadre d'apprentissage profond pour le problème de classification à partir des labels bruités. Des applications au scoring bancaire permettront de construire un score d'acceptation personnalisé, adapté aux critères spécifiques de chaque client.

8. **Azadeh Khaleghi** (ENSAE)

Titre: Estimating mixing coefficients from dependent sample paths with connections to sequential decision making

Résumé: Many problems in statistics and machine learning involve dependent time series, where classical i.i.d. assumptions fail and finite-sample guarantees depend on how quickly dependence decays. Mixing coefficients quantify this decay and appear explicitly in concentration inequalities for dependent data, yet strong, unverifiable assumptions are typically imposed on them. In this talk, I consider the problem of estimating mixing coefficients from a single stationary ergodic sample path. I will present general results showing that α - and β -mixing coefficients can be consistently estimated and used to test the strength of dependence, while also highlighting the inherent challenges and limitations of this problem in full generality. I will then discuss more structured settings, such as geometrically ergodic Markov processes, where additional regularity makes the problem more tractable and yields estimators with explicit convergence rates. Finally, I will highlight implications for sequential decision making, focusing on restless bandit problems where pay-off distributions may exhibit long-range dependence, and conclude with open challenges in adaptive settings.

9. **Ehud Ockegna** (Université Jean Monnet)

Titre: Deep nonparametric regression under covariate shift

Résumé: This study focuses on addressing the challenge posed by covariate shift in nonparametric quantile and Huber regression by using sparse-penalized regularization for deep neural networks (SPDNN). We consider data that satisfy the Bernstein-type inequality, such as iid observations, ϕ -mixing, strong mixing, and \mathcal{C} -mixing processes. To mitigate the effects of distribution shift, we propose a two-stage procedure. In the first stage, we propose an estimation procedure for the density ratio by minimizing least squares in both bounded and unbounded density ratio scenarios. In the second stage, the SPDNN is obtained using pre-trained weights. We provide error bounds for unweighted, reweighted, and pre-training reweighted estimators.

10. **Jordan Patracone** (Université Jean Monnet, Télécom Saint-Etienne)

Titre: Conformal Online learning of deep Koopman linear embedding

Résumé: A particularly powerful framework for analyzing complex systems over time is provided by operator-theoretic approaches, such as the ones based on the Koopman operator, which recast nonlinear dynamics into linear evolution in function space. In this talk, I will introduce a novel framework for adaptively updating Koopman-invariant representations of nonlinear dynamical systems from streaming data. Our modeling approach combines deep feature learning with multistep prediction consistency in the lifted space, where the dynamics evolve linearly. To prevent overfitting, we introduce a conformal-style mechanism that shifts the focus from evaluating the conformity of new states to assessing the consistency of the current Koopman model. Updates are triggered only when the current model's prediction error exceeds a dynamically calibrated threshold, allowing selective refinement of the Koopman operator and embedding.

11. **Lionel Truquet** (ENSAI)

Titre: On the Transfer of Mixing Rates for Markov Chains in Random Environments, with Applications to Time Series Analysis and Machine Learning

Résumé: For the analysis of time series or the study of the convergence of certain stochastic algorithms, such as those based on Langevin dynamics, discrete-time Markov processes are naturally perturbed by the introduction of stochastic disorder, which may be referred to as noise, an exogenous factor, or a random environment depending on the terminology used across different fields. The aim of this presentation is to show that one can study the stability of these Markov chains in random environments on unbounded spaces using adapted versions of more classical stability conditions (drift conditions, small set conditions, or contraction of random mappings). Sufficient conditions for the existence of stationary and ergodic measures, as well as control of the alpha-mixing coefficients for these processes, can then be obtained. From this, one can derive a limit theory for autoregressive processes with exogenous covariates, quantify mixing rates for the study of deep learning algorithms, and obtain qualitative estimates of the convergence rates of certain stochastic algorithms.

12. **Modou Wade** (CY Cergy Paris Université)

Titre: Deep regression learning from dependent observations with minimum error entropy principle

Résumé: This work considers nonparametric regression from strongly mixing observations. The proposed approach is based on deep neural networks with minimum error entropy (MEE) principle. We study two estimators: the non-penalized deep neural network (NPDNN) and the sparse-penalized deep neural network (SPDNN) predictors. Upper bounds of the expected excess risk are established for both estimators over the classes of Hölder and composition Hölder functions. For the models with Gaussian error, the rates of the upper bound obtained match (up to a logarithmic factor) with the lower bounds established in Schmidt-Hieber (2020), showing that both the MEE-based NPDNN and SPDNN estimators from strongly mixing data can achieve the minimax optimal convergence rate.

13. **Olivier Wintenberger** (Sorbonne Université)

Titre: Stochastic Rainfall Occurrence Generator with Long Periods of Drought

Résumé: Stochastic weather generators (SWGs) are indispensable for risk assessment and down-scaling. Yet commonly used Markov and hidden-Markov formulations struggle to reproduce the heavy-tailed persistence of dry spells in daily rainfall records. We propose a single site rainfall-occurrence SWG based on alternating-renewal, also called spell-length, modeling. Dry and wet durations are modeled directly, assuming independence between successive spells and avoiding the exponentially decaying sojourns implied by regular Markov chains. We describe a version of our model relying on extended generalized Pareto distribution in order to have a flexible approach, modeling the entire distribution with a special focus on extremes. Our theoretical contribution is an explicit, closed-form connection between alternating-renewal chains and a broad class of Markov models. This bridge clarifies the asymptotic behavior of the proposed class and enables the practical transfer of methods developed for any of the approach across the two frameworks. We calibrate the model to daily rainfall-occurrence series across multiple European locations. The generator accurately reproduces persistence metrics and upper quantiles of dry-spell lengths, with notable gains in southern Europe where extreme dry spells are observed. The results illustrate the flexibility and efficiency of spell-length-based occurrence modeling for synthetic rainfall generation.