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**Laboratoire d'Informatique Médicale et des Environnements Dynamiques et intelligents (LIMED)**

# Séminaire Hebdomadaire du Laboratoire LIMED : *Compte rendu des présentations 2023-2024*

**Dr Khaled BEDJOU** — **Responsable du Séminaire**
**Pr Hachem SLIMANI** — **Directeur du LIMED**

**Adresse :** Laboratoire d'Informatique Médicale et des Environnements Dynamiques et intelligents (LIMED), Faculté des Sciences Exactes, Université de Bejaia, Route de Targa Ouzemour, 06000 Bejaia, Algérie.
**E-mail** : laboratoire.limed@univ-bejaia.dz

# Séminaire Hebdomadaire du Laboratoire LIMED :

## *Compte rendu des présentations 2023-2024*



**Adresse :** Laboratoire d'Informatique Médicale et des Environnements Dynamiques et intelligents (LIMED), Faculté des Sciences Exactes, Université de Bejaia, Route de Targa Ouzemour, 06000 Bejaia, Algérie.
**E-mail** : laboratoire.limed@univ-bejaia.dz

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# Optimizing the execution of parallel code on GPU

Baya Ait Moula, Abderrahmane Sider, Nabil Djebari

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : baya.aitmoula@univ-bejaia.dz ; abderrahmane.sider@univ-bejaia.dz ; nabil.djebari@univ-bejaia.dz

**Abstract :** The evolution of Central Processing Units (CPUs) from the 19th century, where the principal units of processing in a computer worked in serial, to the present day, has been marked by significant advancements. Intel's 14th generation Core i9 can have up to 24 cores [1], and AMD's TRX50 can reach up to 96 cores [2], showcasing the incredible growth in core counts over the years. However, despite this impressive growth, CPUs have limitations when it comes to handling complex tasks such as artificial intelligence (AI). This is where Graphical Processing Units (GPUs) have emerged as a powerful alternative, which expanded beyond gaming and image processing to parallel processing of complex tasks, especially those related to AI. In this presentation, we delve into the fundamental differences between CPUs and GPUs and then, explore the crucial concept of execution configuration in GPU programming. This requires an understanding of GPU architecture elements including threads, blocks, streaming multiprocessors (SMs), etc. Serving for optimizing and efficiently utilizing the parallel processing capabilities of GPUs.Furthermore, we navigate the realm of optimization and highlight its importance in the age of AI, providing a classification of most common hyperparameter techniques. A categorization of auto-tuners will be presented, followed by a comparative table summarizing several works from the literature related to this subject. To conclude, the presentation will delve into prospective directions for future research and outline our envisioned improvement in optimizing code execution on GPUs.

**Key words :** Machine learning ; parameter optimization ; grid search ; random search ; gradient-based optimization ; CUDA ; CUDA kernel ; CUDA program acceleration

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# Data Management Systems with the Emergence of Big Data and IoT

Yanni Ammar Khodja, Samia Chibani, Badrina Gasmi

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : yanni.ammarkhodja@univ-bejaia.dz ; samia.chibani@univ-bejaia.dz ; badrina.gasmi@univ-bejaia.dz

**Abstract :** In an environment where data collection and connectivity are expanding at an exponential rate, Big Data and the Internet of Things (IoT) are becoming essential components of our contemporary technology architecture. Through the use of sensors, IoT makes it possible for real or virtual things to be connected to the internet, creating new channels for communication between the digital and physical worlds. Simultaneously, Big Data is driving the digital revolution to unprecedented heights because of its capacity to handle enormous amounts of data in real-time and provide previously unheard-of chances for analysis and decision-making. The integration of these two domains in smart environments is the main focus of our study, where effective data management emerges as a significant issue to improve the relevance and performance of computer systems across a range of industries and sectors, including industry, logistics, environmental management, and healthcare. In order to improve data exploitation and support informed decision-making and process optimization in an increasingly interconnected environment, our research intends to develop novel techniques by highlighting the convergence of IoT and big data.

**Key words :** Big Data ; IoT ; Data management system ; Data architecture ; Smart Environment

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# Gestion et Représentation de Contexte dans le cas de l'Activité Humaine

Hocine Attoumi, Achour Achroufene

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : hocine.attoumi@univ-bejaia.dz ; achour.achroufene@univ-bejaia.dz

**Abstract :** La reconnaissance des activités humaines (HAR) est un domaine de recherche très actif, car il est essentiel dans plusieurs domaines tels que la sécurité pour détecter les activités normales ou suspectes, la santé pour surveiller les patients, ou encore la robotique qui tente de reproduire les activités humaines. Pour tenter de reconnaître de telles activités, des modèles de machine learning de plus en plus robustes sont implémentés pour répondre aux besoins de cette problématique en suivant différents types de processus, de la collecte de données au déploiement de ces modèles. Pour la collecte de données, l'une des solutions proposées est l'utilisation de capteurs inertiels, tels que l'accéléromètre, qui ont fait leurs preuves dans plusieurs recherches. Cependant, en ne considérant que des données inertielles, les activités reconnues sont très limitées, car il n'y a pas suffisamment d'informations pour caractériser davantage la situation de l'utilisateur pendant qu'il accomplit ces activités. Ces informations sont appelées *contexte*. Un système HAR est sensible au contexte s'il inclut ces informations caractérisant une entité, qu'il s'agisse de la personne, de l'appareil (capteurs inertiels, smartphones, etc.), ou encore de l'application qui fait le lien entre l'utilisateur et l'appareil. Dans cette présentation, nous introduisons d'abord ces concepts liés à la HAR et aux contextes, puis nous proposons un état de l'art et une comparaison entre des méthodes de la littérature qui traitent notre problématique. Nous exposons également une taxonomie pour classifier différents contextes que nous avons recensés. Enfin, nous présentons une idée de contribution ainsi que les problèmes rencontrés pour des solutions potentielles.
**Key words :** Reconnaissance d'activités humaine ; Sensibilité au contexte ; IoT ; Machine Learning ; Dynamisation

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# Détection d'intrusions dans les VANETs

Mounir Boudjelel, Lamia Hamza, Siham Bouchelaghem

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : mounir.boudjelel@univ-bejaia.dz ; lamia.Hamza@univ-bejaia.dz ; Siham.bouchlaghem@univ-bejaia.dz

**Abstract :** The vehicle ad hoc network (VANET) is one of the mainstreams vehicular communication technologies for the intelligent vehicles witch represent nodes in VANETs that can share real-time information about their movement state, traffic situation, and road conditions. However, the cyberattacks on VANETs create life threatening situations and/or cause road congestion. The IDS is one of the most popular approaches to protect VANETs from intrusions and cyber-attacks. It can detect intrusions and cyber-attacks based on various strategies. IDS design approaches in Vanets are divided into two main classes : the **classic (algorithmic)** approach and the approach **based on machine learning**. The choice between traditional and machine learning approaches depends on the specific needs of the intrusion detection system. Conventional methods provide a solid foundation and clear understanding of known attacks, while machine learning approaches are better suited to detect unknown and emerging attacks. in this presentation we tried to visualize the contributions and the inconvenients for each approach.

**Key words :** VANETs ; IDS ; Classic ; Machine learning

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# Nouvelles techniques contre les perturbations des Systèmes de Transport Intelligents

Lamia Hammiche, Lamia Hamza

Laboratoire LIMED, Faculté des Sciences Exactes,Université de Bejaia, 06000 Bejaia, Algérie
Emails : lamia.hammiche@univ-bejaia.dz ; lamia.hamza@univ-bejaia.dz

**Abstract :** Les Systèmes de Transport Intelligents (STIs) consistent à appliquer les technologies de détection, d'analyse, de contrôle et de communication au secteur des transports pour améliorer la sécurité, la sureté, la mobilité et l'efficacité. Ils offrent de grandes opportunités de développement, tant autour des véhicules communiquant entre eux et avec l'infrastructure, mais aussi autour de nouveaux services de mobilité. En dépit de ces possibilités d'améliorer la qualité des transports, les STIs sont confrontés à des situations inédites et imprévues qui n'ont été envisagées à l'étape de la conception. Ils peuvent également introduire des risques de Cyber-Sécurité dans les réseaux de transport. Grâce aux dispositifs IoT (Internet of Things) et la technologie de communication 5G, la conduite d'un véhicule connecté devient simple. Toutefois, ce type de véhicule dépend grandement des messages, tels que, les avis d'accident, les avertissements de collision, les avertissements de freinage, etc., qui peuvent être utilisés par un attaquant pour distraire le conducteur ou modifier le comportement de conduite afin de répondre aux intentions d'un attaquant. Pour surmonter ces problèmes, des solutions basées sur l'intelligence artificielle sont apparus comme une direction de recherche prometteuse, offrant des possibilités innovantes pour renforcer la sécurité et la fiabilité des systèmes de transport intelligents.

**Key words :** Systèmes de Transport Intelligents ; Véhicules connectés ; Attaques ; Machine Learning.

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# Optimised Data Management in Intelligent Environments

Meriem Iouknane, Samia Chibani

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : meriem.iouknane@univ-bejaia.dz ; samia.chibani@univ-bejaia.dz

**Abstract :** Optimised data management in intelligent environments represents a major and crucial challenge for maximising the efficiency of the collection, storage, processing and use of data generated in these dynamic and complex contexts. This discipline aims to develop specific optimisation techniques that take into account the quality of service required to meet the evolving and often demanding needs of the intelligent environment community. By integrating advanced optimisation methods and adapted algorithms, the objective is to meet the unique challenges posed by data management in environments where data is massive, heterogeneous and generated in real time.By facilitating more informed decision-making, more efficient processes and an overall improvement in services and performance, this research aims to fully exploit the potential of intelligent environments to meet the needs of modern society.

**Key words :**Optimisation Techniques ; Big Data ;Smart House ;Intelligent environment ;Data Management ; Smart City ;

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# Proposition d'une Méthode de Sélection de Caractéristiques Hybride pour la Reconnaissance des Activités Humaines

Redouane Saifi, Achour Achroufene

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : redouane.saifi@univ-bejaia.dz ; achour.achroufene@univ-bejaia.dz

**Abstract :** La Reconnaissance des Activités Humaines (HAR) est un domaine de recherche très actif, car il est essentiel dans divers domaines tels que la santé, la surveillance, le sport, la robotique, etc. De nombreux systèmes HAR sont basés sur des algorithmes d'Apprentissage Automatique (ML). Cependant, le déploiement de ces systèmes est souvent un défi majeur en raison de leur complexité spatiale et temporelle, en particulier dans les applications en temps réel où une reconnaissance quasi-instantanée est impérative. Cette présentation propose une nouvelle approche hybride de sélection de caractéristiques qui optimise le temps d'exécution d'un système HAR. La sélection de caractéristiques combine les algorithmes de Recherche du Coucou (CS) et d'Élimination de Caractéristiques Récursives (RFE). Par la suite, les caractéristiques sélectionnées alimentent divers algorithmes de classification ML tels que la Machine à Vecteurs de Support (SVM), la Forêt Aléatoire (RF) et la Régression Linéaire (LR) pour reconnaître les activités. L'approche proposée réduit significativement le nombre de caractéristiques et, par conséquent, la complexité temporelle. Les résultats de l'expérience menée sur l'ensemble de données UCI-HAR rivalisent avec ceux obtenus dans l'état de l'art en utilisant moins de caractéristiques

**Key words :** Reconnaissance d'activités humaine ; Sélection de caractéristiques ; IoT ; Machine Learning ; temps réel

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# Gestion Intelligente de la Méthode d'Accès au Canal Radio Cognitive

Katia Abdoune [a], Djamila Boukerdera [b], Karima Adel-Aissanou [c]

[a] Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
[b] Laboratoire LMA, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
[c] Unité de Recherche LaMOS, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : katia.abdoune@univ-bejaia.dz ; djamila.boukredera@univ-bejaia.dz ; karima.aissanou@univ-bejaia.dz

**Abstract :** Avec le développement de la 5G et de l'Internet des objets, de nombreux appareils sans fil doivent partager les ressources spectrales limitées. Le spectre radioélectrique disponible est insuffisant pour répondre efficacement à la demande croissante des applications sans fil. Cependant, sur une période donnée, certaines bandes allouées sont sous-utilisées, tandis que d'autres sont surchargées, ce qui gaspille une énorme capacité spectrale et aggrave la rareté du spectre. Par conséquent, La technologie d'accès dynamique au spectre permet d'accéder de manière flexible au spectre disponible en fonction de la demande des utilisateurs, ce qui est envisagé comme une technologie prometteuse pour résoudre les problèmes actuels d'inefficacité du spectre. Cependant, pour mettre en place une gestion intelligente du spectre, il est nécessaire de recourir à des techniques d'intelligence artificielle pour analyser les données du réseau et prendre des décisions optimales. Dans le cadre de notre thèse, nous nous étudions le problème de l'accès dynamique au spectre pour plusieurs utilisateurs dans un environnement de radio cognitive multi-canal en utilisant l'apprentissage profond récurrent par renforcement. Plus précisément, le réseau se compose de multiples utilisateurs principaux (PU) transmettant de manière intermittente sur leurs canaux respectifs, tandis que les utilisateurs secondaires (SU) tentent d'accéder de manière opportuniste aux canaux lorsque les PU ne transmettent pas. Cela nécessite que les SUs effectuent périodiquement une détection du spectre sur différents canaux et n'accèdent qu'aux bandes vacantes. Un environnement multi-agent est considéré où chacun des SUs réalise un apprentissage par renforcement indépendant pour apprendre la politique appropriée de transmission opportuniste afin de minimiser les collisions avec les autres utilisateurs. L'objectif d'une telle gestion dynamique est de maximiser le taux d'exploitation du spectre radio tout en minimisant les interférences avec les autres utilisateurs.

**Key words :** Accès dynamique au spectre (DSA) ; Gestion intelligente du spectre ; Intelligence artificielle (IA) ; Radio Cognitive (RC) ; Apprentissage profond récurrent par renforcement (DRQN) ; Environnement multi-agent.

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# Enhancing Security in Virtually Coupled Trains : Real-Time Communication Attack Detection and Predictive Speed Adaptation

Lydia Yahiaoui, Mohamed Mohammedi

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : lydia.yahiaoui@univ-bejaia.dz ; mohamed.mohammedi@univ-bejaia.dz

**Abstract :** L'introduction des trains virtuellement couplés (VCTS) constitue une avancée majeure dans le domaine du transport ferroviaire, offrant des perspectives prometteuses pour améliorer l'efficacité opérationnelle et la satisfaction des passagers. Cependant, cette innovation nécessite l'établissement de communications sans fil et en temps réel entre les trains (T2T), ce qui les rend vulnérables aux attaques cybernétiques. Ces attaques peuvent avoir des conséquences néfastes telles que la modification des données, la perturbation de la transmission des données et le vol d'informations. Afin de relever ces défis, nous proposons un système basé sur l'apprentissage automatique qui combine la détection d'intrusion en temps réel et la prédiction de vitesse. Notre système analyse le trafic réseau à l'aide d'algorithmes d'apprentissage automatique afin de détecter les activités suspectes ou malveillantes. En cas d'attaque, le système ajuste la vitesse du train pour éviter toute collision. Dans cet exposé, je commencerai par présenter les connaissances fondamentales, puis je proposerai une taxonomie permettant de classer les travaux antérieurs. Ensuite, je détaillerai notre contribution en exposant la méthodologie adoptée ainsi que les résultats obtenus. Enfin, je conclurai en abordant les perspectives futures.

**Key words :** Communication en temps réel, détection d'intrusion, apprentissage automatique, trains virtuellement couplés, sécurité des communications, prédiction de vitesse.

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# Self-Template features for Instantaneous Walking pattern classification

Fahem Ameziane [a], Achour Achroufene [a] , Djamila Boukerdera [b]

[a] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaîa, Algeria
[b] LAM Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaîa, Algeria
Emails : fahem.ameziane@univ-bejaia.dz ; achour.achroufene@univ-bejaia.dz ; djamila.boukredera@univ-bejaia.dz

**Abstract :** This study introduces a novel method for real-time walking pattern classification called self-template features. Traditional approaches face challenges in real-time scenarios due to factors like window size, sensor noise, high-dimensional [1] and template management [2]. Self-template features overcome these limitations by directly constructing data representations from short segments of an individual's walking pattern, eliminating the need for predefined templates or feature selection. This approach offers adaptability to various sensor modes and window sizes constraint, making it suitable for real-time analysis. The research evaluates two algorithms utilizing self-template features and compares their performance with traditional methods [2,3] on a designated dataset. Results showcase the effectiveness of self-template features in achieving robust and accurate walking pattern classification in real-time.
**Keywords :** Walking pattern classification ; IMU ; Gait analysis ; Real-time analysis

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# Introduction to Transformers and their applications in age estimation from facial images

Cilia Azni [a], Mohammed Khammari [b]

[a] LIMED Laboratory, Department of Automation, Telecommunications and Electronics (ATE), Faculty of Technology
[b] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails :cilia.azni@univ-bejaia.dz ; mohammed.khammari@univ-bejaia.dz

**Abstract :** In recent years, the emergence of Transformers, primarily popularized in the natural language processing domain, has sparked keen interest within the computer vision community. We will presents an in-depth exploration of the use of Transformers in computer vision. We highlight how Transformer models, have revolutionized traditional image processing approaches by adopting an attention-based architecture. We also discuss key advantages of Transformers, such as their ability to capture long-range dependencies in images and their scalability to different computer vision tasks. Furthermore, we will explore practical applications of Transformers in the specific area of age estimation from facial images.
**Key words :** Transformers ; Computer vision ; Age estimation ; Deep Learning

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# Selection of contextualized services supporting human activity

Lydia Souici [a], Achour Achroufene [a], Mohamed Essaid Khanouche [b]

[a] Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
[b] Laboratoire d'InfoRmatique en Image et Systèmes d'information (LIRIS)
Laboratoire LITAN
Emails : lydia.souici@univ-bejaia.dz ; achour.achroufene@univ-bejaia.dz ;mekhanouche@gmail.com

**Abstract :** Intelligent environments offer many advantages, such as energy management, security, and service provision to their occupants. However, the provision of services is still an issue as the required service depends strongly on the occupant and the application context.

Within this context, this thesis aims to study and design an ambient intelligent system dedicated to the assistance of people, in particular seniors and those with special needs. Indeed, the proliferation of smart objects, with the Internet of Things (IoT), allows the environment, home or building, or even city, to become intelligent by adapting to people's lifestyles and assisting them in their daily lives. Thus, the assistance of people in their daily lives consists in providing services on demand or according to the context. Smart objects form a network and cooperate to choose the appropriate service. When the requested service isn't available locally, the network can forward the request to other objects in other networks. The quality of service can be ensured by service composition or object socialization in the IoT. Finally, the system design involves exploiting interconnected objects interacting with the physical environment to provide services to help people in their activities.

**Key words :** Internet of Things ;Ambient Intelligence ; Human activities ; Machine Learning ; Social Internet of Things ; Service Selection, Context.

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# Gestion des données dans un environnement Multi-Cloud

Narimane Bair [a], Lamia Hamza [a], Nacer Hassina [b]

[a] Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
[b] Laboratoire MOVEP, université des Sciences et de la Technologie Houari Boumediene, Alger
Emails : narimane.bair@univ-bejaia.dz ; lamia.hamza@univ-bejaia.dz ; sino_nacer@yahoo.fr

**Abstract :** À l'ère des avancées technologiques, le volume et la variété des données ne cessent de croître. Ces données se présentent sous différentes formes : textes, images, sons, vidéos, etc. La nature volumineuse et la variété des données pose de nombreuses difficultés, notamment en termes de stockage, de gestion de la sécurité des ces données. Le cloud computing offre une solution idéale pour répondre à ces défis en fournissant des services de stockage et de traitement des données à la demande en fonction des besoins. Ces services sont offerts par l'intermédiaire des fournisseurs de services (Cloud Services Provider (CSP)). Toutefois, l'existence de CSP en tant que tiers de confiance, créant ainsi une centralisation de données et des services, rend le Cloud Computing peu fiable et pose de nombreux problèmes de sécurité de de gestion de données. Cependant, la technologie Blockchain, grâce à son système décentralisé résout le problème de centralisation car la Blockchain offre un registre distribué et immuable et qui permet de vérifier les transactions de manières transparentes. Bien que la technologie Blockchain ait résolu le problème de centralisation dû aux CSPs, mais le stockage de l'ensemble de données dans un cloud unique pose toujours un problème car en cas d'attaques externes, les données peuvent être compromises ou modifiées ou si un CSP décide d'arrêter son service, les données seront totalement ou partiellement perdues. Pour remédier à ces problèmes, les utilisateurs et les entreprises ont optés pour l'utilisation des Multi-Cloud qui est une collection de plusieurs infrastructures cloud dont les données sont stockées dans plusieurs endroits différents afin d'améliorer la résilience et la disponibilité de données en cas de défaillance ou d'attaques ciblées.

**Key words :** Données volumineuses ; Cloud Computing ; Multi-cloud ; Blockchain ; Sécurité.

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# Identification RFF pour la technique d'accès NOMA dans les réseaux cellulaire 5G

Dalil Beknadj, Mohamed Azni

LIMED Laboratory, Faculty of Technology, University of Bejaia, 06000 Bejaia, Algeria
Emails : dalil.beknadj@univ-bejaia.dz ; mohamed.azni@univ-bejaia.dz

**Abstract :** L'optimisation de l'accès multiple par répartition non orthogonale (NOMA) dans les réseaux 5G représente un défi technique majeur en raison des interférences générées lors de la superposition de signaux d'utilisateurs multiples. Le NOMA permet à plusieurs utilisateurs d'accéder simultanément aux mêmes ressources spectrales, ce qui améliore l'efficacité spectrale globale du réseau. Cependant, cela introduit des interférences, notamment lors de l'accès aléatoire via le canal physique d'accès aléatoire (PRACH).

Dans cette étude, nous avons développé une méthode d'identification d'empreinte radiofréquence (RFF) pour distinguer les utilisateurs dans des scénarios d'accès multiples. L'identification RFF permet de caractériser les signaux émis par chaque utilisateur selon des propriétés uniques de l'émetteur, facilitant ainsi la détection des utilisateurs superposés lors des transmissions NOMA.

Nous avons appliqué des réseaux de neurones convolutifs (CNN) pour l'analyse et la classification des signaux PRACH, permettant de différencier et d'isoler les signaux superposés d'utilisateurs multiples, même dans des environnements densément peuplés. Les résultats montrent que l ?utilisation de cette approche améliore la détection des interférences, optimise l'allocation des ressources radio et réduit les collisions entre utilisateurs. De plus, l'intégration de l ?identification RFF améliore la précision dans la gestion des interférences et la fiabilité du réseau.

Cette solution contribue à l'amélioration des performances des réseaux cellulaires 5G en termes d'efficacité spectrale, de réduction des interférences et d'amélioration de la qualité de service (QoS), particulièrement dans les scénarios à forte densité d'utilisateurs.

**Key words :** NOMA, 5G, PRACH, CNN, Interférence, Réseaux radio.

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# Big Data analytics for earthquake management

Khedoudja Bouafia [a], Hachem Slimani [a], Hassina Nacer [b]

[a] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
[b] MOVEP Laboratory, Computer Science Department, University of Science and Technology Houari Boumediene, Algiers 16000, Algeria
Emails : khedoudja.bouafia@univ-bejaia.dz ; hachem.slimani@univ-bejaia.dz ; sino_nacer@yahoo.fr

**Abstract :** Earthquakes are unexpected geological events that happen in some seconds, and they cause enormous damage in terms of both human and material losses. That is why earthquake and seismic risk preparedness is essential to reduce the negative impact of these events. Big Data technologies [2] offer new possibilities for improving understanding, prediction and response to earthquakes. Furthermore, Big Data Analysis (BDA) [4] offers numerous possibilities for improving emergency situations [3], particularly earthquakes, whose collected data can be rapidly analyzed to identify areas at risk, monitor the evolution of the situation and guide interventions. In this paper, we present a review of the state-of-the-art approaches based on BDA techniques for earthquake management. In this setting, we propose a new classification that allows to structure the main existing works, dedicated to the studied subject, into relevant categories. This classification has allowed us to understand especially the difficulties to set up in practice the results and conclusions of some works ; and moreover the importance to investigate more the issue by involving BDA techniques combining with new technologies in particular Mobile Internet of Things (MIoT) [1, 3]. To achieve this, we have highlighted some relevant challenges related to Big Data analysis that can be faced.
**Key words :** Emergency management ; Earthquake management ; Big Data Analytics ; Rescue management.

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# Advanced Deep Learning Techniques for Classifying Diabetic Retinopathy

Yacine Hachi [a], Soraya Tighidet [a], Kamal Amroun [a], Meriem Djouadi [b]

[a] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
[b] Laboratory of Operator Theory and EDP : Foundations and Application, Faculty of Exact Sciences, University of El Oued, Algeria
Emails : yacine.hachi@univ-bejaia.dz ; soraya.tighidet@univ-bejaia.dz ; kamal.amroun@univ-bejaia.dz ; djouadi-meriem@univ-eloued.dz

**Abstract :** Diabetic retinopathy (DR) is a major health issue on a global scale linked to diabetes, impacting millions globally and resulting in both microvascular and macrovascular complications. This condition presents with different signs in the retina such as microaneurysms, hemorrhages, and the development of new blood vessels. Prolonged duration of diabetes, inadequate glycemic control, high blood pressure, being overweight, ethnicity, economic status and genetic predisposition are all potential risk factors. Diabetic retinopathy can lead to vision loss and blindness, often managed with treatments such as laser therapy, injections of vascular endothelial growth factor inhibitors, and vitrectomy. The development of diabetic retinopathy is linked to oxidative stress, inflammation, and impaired neuronal function. Cytokines such as VEGF are known to have significant involvement in the process. Comprehensive comprehension of the intricate nature of the disease facilitates the creation of specific treatments for effectively managing diabetic retinopathy. However, the process of manual diagnosis is time-consuming, costly, and demands the expertise of an ophthalmologist to analyze images of the retina's fundus. Deep learning techniques in recent research have shown significant promise for the identification and classification of DR, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), Deep transfer learning. This research investigated and assessed the latest advancements in deep learning methods for identifying and classifying retinopathy in individuals affected by diabetes. While deep learning has reached or exceeded the level of accuracy achieved by humans in diagnosing and grading diabetic retinopathy, there is still significant progress needed for its integration into real clinical workflows. This involves enhancing the interpretability of models and gaining trust from ophthalmologists.

**Key words :** Diabetes ; retinopathy ; microaneurysms ; deep learning ; CNNs ; RNNs ; Deep transfer learning ; Classification.

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# Gestion de ressources dans un réseau 5G assisté par drones

Yasmina Machter [a], Mohamed Azni [a], Mohamed amine Ouamri [b]

[a] Laboratoire LIMED, Faculté de Technologie, Université de Bejaia, Bejaia 06000, Algeria
[b] Université de Grenoble Alpes, INP Grenoble, CNRS, LIG, Drakkar Teams, Grenoble 38000, France
Emails : yasmina.machter@univ-bejaia.dz ; mohamed.azni@univ-bejaia.dz ; ouamrimouhamedamine@gmail.comr

**Résumé :**

Avec la densification des appareils connectés et l'essor des équipements mobiles haute performance, les réseaux de communication sans fil connaissent une demande croissante en capacité et couverture. Pour répondre à ces besoins en constante évolution, en particulier avec l'avènement des réseaux 5G et des avancées technologiques futures, de nouvelles solutions novatrices doivent être envisagées. Parmi les pistes explorées, l'utilisation de drones comme stations de base aériennes soulève un vif intérêt [1]. Ces véhicules aériens sans pilote (UAV) offrent en effet de nombreux atouts pour les réseaux mobiles. Leur mobilité permet un déploiement rapide et flexible d'une couverture spécifiquement dans les zones surchargées, les situations d'urgences et les zones mal desservies [2],[3]. Leur position aérienne favorise également des liaisons en visibilité directe. Cependant, pour intégrer efficacement les drones dans les communications sans fil, plusieurs défis techniques doivent être relevés, il s'agit notamment du positionnement 3D optimal des drones [4], de la planification de leurs trajectoires de vol [5] et de l'allocation optimale des ressources disponibles [6],[7]. Cette dernière, cruciale pour maintenir les performances du réseau assisté par drones, englobe la couverture, la capacité, l'efficacité spectrale et énergétique, ainsi que la connectivité et la fiabilité des communications. C'est sur ce dernier point, l'allocation optimisée des ressources dans les réseaux cellulaires assistés par drones, que porte notre travail.

**Mots clés :** Réseaux celullaires ; 5G ; Allocation de ressources ; UAV ; Optimisation

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# Non-invasive learning-based methods for risk assessment and diagnosis of type 2 diabetes

Mohammed El Amine Mihoubi, Abderrahmane Sider, Kamal Amroun

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : mohammed.mihoubi@univ-bejaia.dz ; abderrahmane.sider@univ-bejaia.dz ; kamal.amroun@univ-bejaia.dz

**Abstract :** Diabetes Mellitus is a global health problem [1], affecting approximately 422 million individuals worldwide and contributing to 1.5 million deaths yearly [2]. Type 2 Diabetes Mellitus (T2DM) is a form of diabetes, accounting for 90-95% of all diabetes cases, and is characterized by insulin resistance and relative insulin deficiency, leading to persistent disturbance in blood glucose levels [3]. Early detection and intervention are critical to prevent serious complications and improve patient outcomes, yet traditional diagnostic methods are invasive and potentially distressing to patients. Emerging non-invasive methods offer a promising alternative, particularly in Artificial intelligence [4] and the use of machine learning and deep learning algorithms to analyze Electronic Health Records (EHR) to detect Type 2 Diabetes. An electronic health record is a digital version of a patient's paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users. The application of artificial intelligence in analyzing EHR could enable fast, accurate, and non-invasive T2DM diagnosis, enhancing patient comfort and accessibility to testing.

**Key words :** Machine Learning ; Deep Learning ; Type II Diabetes ; Risk Assessment ; Diagnosis ; Non-invasive methods

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# Layered Min-Sum decodes for 5G NR LDPC

Nour El Houda Zareb, Mohamed Azni, Meriem Gagaoua

LIMED Laboratory, Faculty of Technology, University of Bejaia, 06000 Bejaia, Algeria
Emails : nourelhouda.zareb@univ-bejaia.dz ; mohamed.azni@univ-bejaia.dz ; meriem.gagaoua@univ-bejaia.dz

**Abstract :** Error-correcting decoding is essential for protecting transmitted information against noise and interference that can cause errors. In 5G networks, LDPC (Low-Density Parity-Check) codes have been adopted due to their ability to offer a reasonable compromise between complexity and bit error rate (BER). Unlike turbo codes used in previous generations, LDPC codes better meet the high throughput, broad connectivity, and low latency requirements of 5G. Our challenge is to achieve an optimal balance between the performance and complexity of Layered Min-Sum decoders.

In this presentation, we explore Layered Min-Sum (LMS) decoding for LDPC codes in the context of 5G NR (New Radio) [1]. LMS decoding is an improved variant of the classical Min-Sum algorithm, optimized for better convergence and enhanced performance [2]. This method decomposes the LDPC parity matrix into sub-matrices, allowing sequential layer-by-layer processing, which reduces computational complexity and accelerates convergence [3].

Our study focuses on developing optimal decoding algorithms and reducing latency. We also present contributions in the form of new algorithms that combine the Belief Propagation Decoder (BP), the Sum-Product Algorithm, and machine learning techniques [4].

In conclusion, Layered Min-Sum decoding represents a promising advancement for 5G digital communication systems, offering efficient solutions to achieve very high data rates while maintaining low latency and reasonable computational complexity.
**Key words :** 5G, Low density parity check codes ; Layered decoding ; LDPC codes ; min-sum (MS) ; iterative decoding.

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# Cellular-Connected UAVs : Energy Harvesting and Data Transmission

Dina Alkama [a], Mohamed Amine Ouamri [a,b], Mohamed Azni [a]

[a] LIMED Laboratory, Faculty of Technology, University of Bejaia, 06000 Bejaia, Algeria
[b] L2TI Laboratory, Departement of Network and Telecommunications, Université, Sorbone, Paris Nord
Emails : dina.alkama@univ-bejaia.dz ; ouamrimouhamedamine@gmail.com ; mohamed.azni@univ-bejaia.dz

**Abstract :** Unmanned Aerial Vehicles (UAVs) have become extremely attractive for a variety of applications due to their autonomy and mobility, making them a fundamental element of the Internet of Things (IoT). For instance, a UAV can perform data collection, deliver packages, remote monitoring, and conduct search and rescue missions. In such applications, wireless connectivity is mandatory for the UAV to perform tasks effectively and operate successfully, thus qualifying it as an aerial user. Integrating UAV users into a traditional cellular network creates what we call a cellular-connected UAV network. Despite the advantages offered by UAVs, their battery capacity remains limited, and the problem of energy constraints persists. On the other hand, harnessing energy through radio frequency (RF) is considered as an appealing and promising power source for energy-limited networks. Typically, within a slot-based system simultaneous wireless information and power transfer (SWIPT) is the most adopted technology to overcome UAV power constraints. The central concept of SWIPT is to simultaneously supply wireless information and energy on demand in the downlink direction. In this work, we consider the simultaneous energy and information transfer in cellular-connected UAVs adopting the SWIPT technology. Specifically, the base stations (BSs) are equipped with up-tilted antennas to provide 3D coverage for aerial users. Using stochastic geometry, the distribution of BSs follows the homogeneous Poisson Point Process (PPP). We investigate the energy coverage probability (ECP) and the signal-to-interference-and-noise ratio coverage probability (SCP) for a typical UAV user assumed to be connected to the nearest BS.

**Key words :** Cellular-connected UAVs ; Coverage Probability ; Stochastic Geometry ; SWIPT ; Up-Tilted Antennas.

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# Prédiction du diabète

Amine Ziane, Houda ElBouhissi, Kamal Amroun

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria.
Emails : amine.ziane@univ-bejaia.dz ; houda.elbouhissi@univ-bejaia.dz ; kamal.amroun@univ-bejaia.dz

**Résumé :** La prédiction du diabète représente un domaine critique de la recherche médicale, où l'application de l'apprentissage automatique et du deep learning promet de révolutionner les méthodologies de diagnostic précoce et de gestion personnalisée. Les modèles prédictifs, basés sur des algorithmes comme les réseaux de neurones, les machines à vecteurs de support et les forêts aléatoires, exploitent de vastes ensembles de données cliniques et biométriques pour identifier les individus à haut risque avant l'apparition clinique de la maladie. Des études récentes soulignent l'importance de l'intégration des données hétérogènes, incluant les mesures glycémiques, les indicateurs de style de vie, et les données génomiques pour améliorer la précision des prédictions. Ces approches sont soutenues par l'augmentation de la disponibilité des données de santé et l'avancée des technologies de traitement et d'analyse des données, posant toutefois des défis en termes de confidentialité des données et d'interprétabilité des modèles.

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# Filtrage automatique des spams Arabes basé sur Machine et Ensemble Learning

Marouane Kihal, Lamia Hamza

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : marouane.kihal@univ-bejaia.dz ; lamia.hamza@univ-bejaia.dz

**Abstract :** Actuellement, l'utilisation de la technologie et la quantité d'informations disponibles sur le web connaissent une croissance rapide et dramatique. Cela est notamment dû aux réseaux sociaux, aux blogs, aux journaux en ligne et à d'autres formes de communication numérique. Parallèlement à cette augmentation, le spamming se développe de manière inquiétante. Les spams sont des messages non sollicités envoyés en masse avec un contenu indésirable ou malveillant. Ces messages peuvent être diffusés en plusieurs langues pour cibler les locuteurs de différentes régions. Le filtrage du spam texte en arabe présente un défi unique en raison de sa grammaire complexe et de ses caractéristiques linguistiques spécifiques. Pour cela, nous avons présenté deux filtres anti-spams arabes basés sur l'apprentissage automatique. Les deux filtres sont basés sur l'ensemble learning des algorithmes pour améliorer l'efficacité par rapport à l'utilisation d'un seul modèle. Le premier filtre combine quatre algorithmes d'apprentissage automatique non supervisé : One-Class Support Vector Machine (OCSVM), Histogram-Based Outlier Score (HBOS), Local Outlier Factor (LOF) et Isolation Forest (IF). Par la suite, notre approche utilise des techniques d'apprentissage par ensemble pour fusionner les résultats. Le deuxième filtre intègre les forces de quatre algorithmes d'apprentissage automatique, à savoir Decision Tree (DT), AdaBoost, Gradient Boosting (XGBoost) et K-Nearest Neighbor (KNN). Les résultats de ces quatre algorithmes ont ensuite été soumis à un processus de fusion au niveau de la décision. Nos filtres ont surpassé une liste d'algorithmes d'apprentissage automatique en obtenant 99% de précision.

**Key words :** Filtrage des spams ; Machine Learning ; Spams Arabes ; Ensemble Learning ; Fusion.

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# Integration of Reinforcement Learning in Safety of Autonomous Vehicles

Tinhinane Chenache [a], Sofiane Aissani [a], Mawloud Omar [b], Abderrahim Mechache [c]

[a] Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie.
[b] IRISA, University Bretagne Sud, France
[c] LIRIS, University Claude Bernard, Lyon 1, France
Emails : tinhinane.chenache@univ-bejaia.dz ; sofiane.aissani@univ-bejaia.dz ; mawloud.omar@univ-ubs.dz ; abderrahim.mechache@univ-lyon1.fr

**Abstract :**

Nowadays, Intelligent Transportation Systems (ITS) play a crucial role in modernizing transportation infrastructure. This research focuses on decision-making for autonomous vehicles using reinforcement learning. The primary objective is to develop a robust approach for the overall behavior of autonomous vehicles. The proposed method enables the vehicle to make appropriate decisions based on learned situations, enhancing its adaptability and performance. Furthermore, we plan to extend this approach to incorporate additional criteria such as driving comfort, rule adherence, and safety. By equipping autonomous vehicles with mechanisms to effectively respond to road disruptions, we aim to improve their navigation capabilities. Experimental results demonstrate a significant improvement in the model's performance. Additionally, the proposed approach holds the potential for addressing decision-making challenges in complex urban environments. This research contributes to the advancement of autonomous vehicles, enabling safe and efficient operations without human intervention.

**Key words :** Intelligent Transportation Systems (ITS) ; Autonomous vehicles ; decision-making, reinforcement learning(RL)

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# Hybrid Approaches to Tackling Challenges in Face Recognition and Anti-Spoofing Techniques

Mebrouka Madi, Mohammed Khammari

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : mebrouka.madi@univ-bejaia.dz ; mohammed.khammari@univ-bejaia.dz

**Abstract :** Facial recognition has a wide range of applications, including personal verification, security, smartphone authentication, and even online banking fraud detection and computer entertainment. A facial recognition system is a verification system that allows the identity of an individual to be found using a biometric method. In general, a facial recognition system consists of two phases : face detection and face identification. This work describes the concept of design and development of a new approach for face spoofing detection using a combination of color texture descriptors with a new convolutional neural network (CNN) architecture. The proposed approach is based on a new convolutional neural network architecture composed of two CNN parallel branches. The first branch is fed by complementary invariant local phase quantization (LPQ) descriptors that result from joint color texture information from the hue, saturation, and value (HSV) color space to accurately capture facial reflection properties of the face. The second branch of the CNN takes an RGB image directly as input, effectively separating chromatic (color-related) information from achromatic (brightness related) information in order to extract crucial facial color features. Each branch of the CNN produces a vector of deep features that are extracted. To effectively concatenate the deep features from the two output branches, we employ an attention mechanism based combination method. This method captures the complementarity of the two branches, improving the accuracy and robustness of the model. The combined feature vectors form an input vector for the next Dense layer, where the model can distinguish between live and spoofed faces. Our method detects 2D facial spoofing attacks involving printed photos and replayed videos. We showcase the effectiveness and superior performance of our approach through a series of experiments conducted on both the CASIA-FASD and Replay-Attack datasets.

**Key words** : Biometric ; Face recognition system ; Pattern recognition ; Computer vision ; Deep learning ; Convolutional neural network (CNN) ; Images classification ; RGB color space ; HSV color space ; Attention mechanism.

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# Amélioration de la Vérification des Liens de Parenté par le Multiscale Retinex et la Combinaison de Caractéristiques Profondes et Superficielles

El Ouanas Belabbaci [a], Mohammed Khammari [b]

[a] LIMED Laboratory, Faculty of Technology, University of Bejaia, 06000 Bejaia, Algeria
[b] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : elouanas.belabbaci@univ-bejaia.dz ; mohammed.khammari@univ-bejaia.dz

**Résumé :** Le défi de la vérification des liens de parenté à partir d'images faciales représente une frontière de pointe et redoutable dans les domaines de la reconnaissance de formes et de la vision par ordinateur. Ce domaine d'étude offre une myriade d'applications potentielles, allant de l'annotation d'images et de l'analyse médico-légale à la recherche sur les médias sociaux. Notre recherche se distingue en intégrant une méthode de prétraitement nommée Multiscale Retinex (MSR), qui améliore la qualité des images et amplifie le contraste, renforçant ainsi les résultats finaux. Stratégiquement, notre méthodologie capitalise sur le mélange harmonieux de descripteurs de texture profondes et superficiels, les fusionnant habilement au niveau des scores grâce à la méthode de régression logistique (LR). Pour expliquer, nous employons le descripteur Local Phase Quantization (LPQ) pour extraire les caractéristiques de texture superficielles. Pour l'extraction de caractéristiques profondes, nous nous tournons vers la puissance du modèle VGG16, pré-entraîné sur un réseau de neurones convolutionnels (CNN). La robustesse et l'efficacité de notre méthode ont été mises à l'épreuve par des expériences méticuleuses sur trois ensembles de données rigoureuses de parenté, à savoir : Cornell Kin Face, UB Kin Face et TS Kin Face.

**Key words :** Vérification des liens de parenté ; CNN ; LPQ ; MSR ; LR Fusion.

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# Improving Service Quality in Intelligent Transportation Systems

Kahina Zizi, Zoubeyr Farah, Sofiane Aissani

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : kahina.zizi@univ-bejaia.dz ; zoubeyr.farah@niv-bejaia.dz ; sofiane.aissani@univ-bejaia.dz

**Abstract :** In recent years, demographic growth, economic expansion, and lifestyle changes have significantly increased the demand for road infrastructure. This heightened demand has spurred the emergence of intelligent transportation systems (ITS), a rapidly growing field. ITS aim to continuously improve the efficiency, safety, and sustainability of transportation systems. Classifying urban traffic conditions is a key component of ITS, as it helps traffic managers understand and analyze congestion while providing travelers with valuable information to avoid traffic jams and take appropriate measures in adverse driving conditions.

Numerous approaches using various characteristics and methods, such as machine learning and artificial intelligence, have been developed to predict and optimize traffic flow. Our work aims to develop an approach that improves service quality in intelligent transportation systems, particularly in areas not covered by the Internet (tunnels, hostile zones, etc.), using an algebraic method called process algebra. Process algebra, a branch of mathematics and computer science, provides a formal framework for describing, analyzing, and reasoning about the behaviors of processes and computer systems.

In this seminar, I will begin by briefly introducing the fundamental concepts of this research field, then I will detail the various stages of my proposal, as well as the simulations conducted.

**Key words :** Intelligent Transportation System(ITS) ; Traffic state ; Vehicular cloud computing ; process algebra.

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# Gestion de données médicales dans un environnement big data : Classification et Perspective

Sara Achouri, Samia Sadouki, Hachem Slimani

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, Bejaia 06000, Algeria
Emails : sara.achouri@univ-bejaia.dz ; samia.chibani@univ-bejaia.dz ; hachem.slimani@univ-bejaia.dz

**Résumé :**

L'adoption croissante des technologies numériques dans le domaine des soins de santé a engendré une croissance exponentielle des données médicales générées, créant un environnement de "Big Data", caractérisé par sa complexité, son hétérogénéité et sa sensibilité [1,2,3]. Cette évolution soulève des défis majeurs en termes de gestion du cycle de vie des données, notamment en termes de leur stockage, de traitement, d'analyse et de sécurité[1,2,4,5,7,8]. Pour relever ces défis, il est crucial de disposer d'une taxonomie structurée [3,5,6,7], complète et à jour couvrant l'ensemble des formats de données médicales [9,10]. Ce travail passe en revue de manière approfondie la littérature concernant les principales entités, sources et types de données médicales dans les systémes de santé modernes, et propose une classification hiérarchique détaillée décrivant les principales catégories de données utilisées à cette fin. Nous mettrons en lumiére les avantages potentiels d'une telle classification hiérarchique pour optimiser la gestion du big data médical tout en soulignant ses forces, limites et lacunes et ses zones d'amélioration potentielles. Cette structuration vise à fournir un cadre robuste pour l'organisation et l'exploitation efficace des données de santé.

**Mots clés :** Big Data ; Systémes de santé ; Données médicales ; Gestion ; Classification hiérarchique

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# Deep learning for Arabic handwritten word recognition in historical documents

Hakim Bouchal [a], Ahror Belaid [b]

[a] LIMED Laboratory, Faculty of Technology, University of Bejaia, Bejaia 06000, Algeria
[b] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, Bejaia 06000, Algeria
Emails : hakim.bouchaluniv-bejaia.dz ; ahror.belaiduniv-bejaia.dz

**Abstract :** Invaluable for historical research, Arabic manuscripts are often challenging to access due to their physical preservation needs. Digitization coupled with handwriting recognition offers a powerful solution for making these resources readily available. However, accurate text recognition hinges on effective segmentation into lines and words. While line segmentation has received significant attention, word detection in historical Arabic script remains an under-explored area due to the scarcity of annotated datasets. This paper addresses this gap by introducing a novel, word-level annotated database specifically designed for historical Arabic manuscripts. We further present two neural network architectures based on Transformers relying on an Arabic language model and a robust CNN-BLSTM with skip connections, guaranteeing the preservation of crucial spatial information for recognition. Validation on a dataset of 20 pages of historical manuscripts demonstrates the effectiveness of the proposed models, achieving a Character Error Rate (CER) of 4.8%, surpassing the state-of-the-art.
**Key words :** Offline words recognition ; Arabic historical document ; Datasets ; Word Detection

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# Surveillance in smart homes

Feriel Khoufache [a], Achour Achroufene [a], Mohand Yazid [b]

[a] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
[b] LaMOS Research Unit, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
*Emails* : feriel.khoufache@univ-bejaia.dz ; achour.achroufene@univ-bejaia.dz ; sofiane.aissani@univ-bejaia.dz

**Abstract :** Surveillance in smart homes relies on the use of sensors to collect data on the home environment. Environmental sensors play a crucial role in detecting information such as temperature, humidity, and brightness. These sensors are distributed across different rooms of the house and allow real-time data collection on environmental conditions. They can be integrated into devices such as smart thermostats, automated lighting systems, or motion detectors.

Human activity recognition (HAR) is a key application of sensors in smart homes. Using sophisticated algorithms, HAR analyzes the data captured by the sensors and identifies the different activities performed by the occupants of the house. For example, it can detect if someone is walking in a room, preparing a meal in the kitchen, or resting in the living room. This allows smart homes to adjust their operation to the detected activities.

The benefits of recognizing human activity in smart homes are many. It improves the comfort and convenience of occupants by automating tasks such as lighting and extinguishing, temperature adjustment, or the management of appliances. In addition, it helps to enhance security by detecting suspicious behavior or intrusions. HAR can also be used to monitor occupants' health and well-being by identifying abnormal activity patterns or detecting falls.

Algorithms for recognizing human activity in smart homes are increasingly using deep learning techniques. These algorithms analyze sensor data and process it to extract specific characteristics related to human activities. They then use these characteristics to classify and recognize different activities. Deep learning allows for greater accuracy and robustness in recognizing human activities, as it can take into account complex factors such as position, speed, and acceleration.

Various approaches and methods have been proposed to improve the accuracy and effectiveness of recognition algorithms, covering specific use cases, such as fall detection in the elderly, sleep quality monitoring, or energy efficiency optimization.

The prospects for future surveillance in smart homes are promising. Smart homes are expected to become increasingly sophisticated, with the integration of more advanced sensors and even more powerful human activity recognition devices. For example, in the field of home health, human activity monitoring can be used to track occupants' lifestyle habits, detect early signs of health problems, or provide support to people with chronic diseases. With continuous advancements in sensors, algorithms, and systems, smart homes will become smarter, more intuitive, and more efficient, offering better quality of life and an improved home experience.

To address the challenges of HAR in the context of smart homes, our work aims to explore AI approaches for recognizing human activity, including machine learning and deep learning algorithms, and to propose a high-performance recognition model capable of meeting the

requirements of smart homes in order to provide appropriate services to residents.
**Keywords :** Smart home ; Surveillance ; Human activity recognition ; Deep learning.

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# A parallel approach for user-centered QoS-aware services composition in the Internet of Things

Asma Cherifi [a], Mohamed Essaid Khanouche [b,c], Yacine Amirat [d], Zoubeyr Farah [a,b]

[a] Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
[b] Laboratoire LITAN, École supérieure en Sciences et Technologies de l'informatique et du Numérique, RN 75, Amizour 06300, Bejaia, Algérie
[c] Université Claude Bernard Lyon 1, Laboratoire d'InfoRmatique en Image et Systèmes d'information (LIRIS) UMR 5205 CNRS, 69100 Villeurbanne
[d] Univ Paris Est Creteil, LISSI, F-94400 Vitry, France
Emails : asma.cherifi@univ-bejaia.dz ; mekhanouche@gmail.com ; amirat@u-pec.fr,zoubeyr.farah@univ-bejaia.dz

**Abstract :** The Internet of Things (IoT) refers to an infrastructure of interconnected smart devices that aim to provide various services. The proliferation of IoT objects and devices offering functionally equivalent services but differing in their quality of service (QoS) levels makes the issue of services composition one of the biggest challenges for the service computing community. Various evolutionary-based approaches have been proposed in the literature to find sub-optimal service compositions in a reasonable computation time. However, most of these approaches have high composition time and/or a limited composition quality as they rely on a sequential exploration of the composition search space using a fixed size population. To address these limitations, a parallel differential evolution-based approach with population size reduction for QoS-aware service composition (PDE-QSC) is proposed. Unlike existing evolutionary-based approaches, the proposed approach is characterized by a parallel exploration of the composition space through a population size reduction strategy. Specifically, in this approach, the composition population is divided into two sub-populations. To reduce the composition time and improve the quality of the composition, the composition sub-populations evolve simultaneously using different evolution processes and are then merged to form a single population, thus increasing the population diversity. To further improve the performance in terms of composition time and composition quality, a linear reduction strategy is proposed to adaptively reduce the size of the composition population by eliminating compositions that do not meet the QoS requirements. Simulations based on real datasets demonstrate the superiority of the PDE-QSC approach over five baseline approaches and its suitability for large-scale IoT environments.

**Key words :** Multi-population Differential Evolution ; Population size reduction ; Internet of Things ; Quality of Service (QoS) ; Services composition.

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# Optimmized QoS-aware services composition using a bio-inspired algorithm in fog computing

Melissa Hammoum [a], Mohamed Essaid Khanouche [b], Nadjet Khoulalene [c]

[a] Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
[b] Université Claude Bernard Lyon 1, Laboratoire d'InfoRmatique en Image et Systèmes d'information (LIRIS), UMR 5205 CNRS, 69100 Villeurbanne, France
[c] LaMOS Research Unit, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria Emails : melissa.hammoum@univ-bejaia.dz ; mekhanouche@gmail.com ; nadjette.khoulalene@univ-bejaia.dz

**Abstract :**

Fog computing is an extension of cloud computing that delivers a range of services with similar functionalities but different quality of service (QoS) levels in order to process data closer to the end-user. As the number of services rapidly increases, selecting the most suitable candidate services that meet user's requirements in terms of QoS is becoming even more challenging. It is therefore necessary to automate the mechanism for selecting the appropriate services in order to satisfy both functional and non-functional user's requirements. To address this, we propose an optimized QoS-aware service composition approach that combines clustering techniques with the shuffled frog leaping algorithm (SFLA) enhanced by dynamic delayed step. This approach groups services based on their QoS attributes to reduce the search space and accelerates the algorithm's convergence through the dynamic adjustments. The integration of clustering with SFLA improves the services composition time and ensures near-to-optimal compositions in large-scale fog computing environments. The simulation results demonstrate that the proposed method is scalable and provides promising results in comparison to other services composition approaches proposed in the literature.

**Key words :** Fog computing ; Services composition ; Quality of Service (QoS) ; K-means method ; Shuffled Frog Leaping optimization Algorithm (SFLA).

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# Characterization and Mitigation of Inter-Numerology Interference in 5G Networks : Modeling and Filtering Approaches

Yacine Ouazziz [a], Mohamed Azni [a], Mohamed Tounsi [b]

[a] Laboratoire LIMED, Faculté de Technologie, Université de Bejaia, 06000 Bejaia, Algerie
[b] Unité de recherche LaMOS, Faculté de Technologie, Université de Bejaia, 06000 Bejaia, Algerie
Emails : yacine.ouazziz@univ-bejaia.dz ; mohamed.azni@univ-bejaia.dz ; mohamed.tounsi@univ-bejaia.dz

**Abstract :** In this presentation, we explore the challenge of inter-numerology interference (INI) in 5G networks, a critical issue arising due to the flexible allocation of resources across multiple numerologies. Our first contribution involves an in-depth analysis of INI, where we characterize interference as a function of frequency response and subcarrier spacing, highlighting how the coexistence of different numerologies leads to performance degradation. Building on this foundation, our second contribution presents a novel filtering approach designed to effectively mitigate INI without resorting to complex windowing techniques. We demonstrate that this method achieves significant improvement in signal separation and Bit Error Rate (BER) performance under varying Signal-to-Noise Ratios (SNR). Together, these studies provide a comprehensive solution to the INI problem, supporting the efficient deployment of 5G systems.

**Key words :** Inter-Numerology Interference (INI) ; 5G Multi-Numerology OFDM ; Frequency-Domain Filtering ; Bit Error Rate (BER) Optimization ; Subcarrier Spacing

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# Intelligent Resource Allocation Techniques in Cloud Computing

Meriem Lahdir [a], Djamila Boulahrouz [b], Karima Adel-Aissanou [c]

[a] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
[b] Applied Mathematics Laboratory (LMA), University of Bejaia, 06000 Bejaia, Algeria
[c] LaMOS Research Unit, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : meriem.lahdir@univ-bejaia.dz ; djamila.boukredera@univ-bejaia.dz ; karima.adel@univ-bejaia.dz

**Abstract :**

In the age of technological development and the ensuing deluge of data, user demands are becoming more fluid and dynamic, leading users to use platforms that meet their requirements, such as the Cloud. The latter is a platform that offers services over the Internet through pay-per-use. Most customers are impatient, and cloud service providers tend to maximise their profits, which makes resource allocation a critical issue. Several techniques are proposed in the literature, among them the use of multi-agent systems. These are associations of intelligent agents, entities working collectively or separately, which are able to perceive their environment, and with the help of optimisation algorithms, influence their surroundings and help make decisions (proactive agents), or even take actions on them (reactive agents). However, the differences in characteristics between Cloud Computing and multi-agent systems compromise the combination between these two platforms. In this work, we will present a classification on resource allocation in the cloud using multi-agent systems.

**Key words :** Resource Allocation ; Cloud Computing ; Multi-Agent Systems ; State of art

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# Algorithmes et techniques de redémarrage pour la résolution des CSPs

Fatima Ait Hatrit, Kamal Amroun

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : fatima.aithatrit@univ-bejaia.dz ; kamal.amroun@univ-bejaia.dz ;

**Abstract :** Les problèmes de satisfaction de contraintes (CSPs), sont un cadre fondamental en intelligence artificielle (IA). Les CSPs, modélisés à travers des variables, des domaines et des contraintes, trouvent des applications dans des domaines tels que l'ordonnancement, la planification et le traitement d'images. Cependant, en raison de leur nature NP-compléte, leur résolution efficace constitue un défi, notamment pour les instances de grande taille ou complexes.

L'étude examine les méthodes classiques et avancées de résolution, en mettant en lumière les limites des approches traditionnelles, telles que la recherche systématique tel que le backtracking, la propagation de contraintes comme la consistance d'arc et la decomposition structurelle des CSPs. Elle explore également les innovations modernes, comme le deep learning et l'apprentissage par renforcement, pour optimiser la résolution des CSPs.

La idée proposée repose sur l'utilisation des techniques de redémarrage associer au algorithmes esploitant la decomposition structurelle des CSPs. Ces techniques permettent de relancer la recherche à partir de points de départ différents, selon des critères prédéfinis, afin d'améliorer les performances des solveurs, en évitant les inefficacités liées aux mauvaises branches initiales dans les arbres de recherche. Cette approche vise à accroitre l'éfficacité et l'évolutivité pour résoudre des CSPs issus de problèmes réels.

Bien que les méthodes classiques offrent une base solide, l'intégration de techniques modernes ouvre la voie à une résolution plus performante et adaptée aux complexités des applications. Les recherches futures se concentrent sur des approches hybrides pour renforcer leur pertinences et leur efficacité.

**Key words :** Problèmes de satisfaction de contraints ; Algorithmes de resolution ; techniques de redémarrage.

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# Heuristique pour la résolution des CSPs

Lillia Ouali, Kamal Amroun

Laboratoire LIMED, Faculté des Sciences Exactes, Université de Bejaia, 06000 Bejaia, Algérie
Emails : lillia.ouali@univ-bejaia.dz@univ-bejaia.dz ; kamal.amroun@univ-bejaia.dz

**Abstract :** Le problème de la satisfaction des contraintes (CSP) représente un domaine d'étude essentiel de l'intelligence artificielle, offrant un large éventail d'applications allant de l'ordonnancement à l'allocation des ressources. Malgré des avancées significatives dans le développement d'algorithmes et d'heuristiques, la résolution efficace d'instances de CSP vastes et complexes continue de poser un défi considérable à la communauté des chercheurs. Les heuristiques traditionnelles ne parviennent souvent pas à naviguer efficacement dans l'espace des solutions et peinent à converger vers des solutions optimales dans un délai raisonnable. Une nouvelle heuristique, ancrée dans les techniques de décomposition d'arbres, spécialement conçue pour améliorer l'efficacité de la résolution de CSP. Notre approche s'appuie sur une stratégie innovante d'ordonnancement des variables, qui réduit systématiquement l'espace de recherche. Nous avons mené des expériences approfondies en utilisant un ensemble d'instances CSP de référence pour valider l'efficacité de l'heuristique proposée. Les résultats démontrent une nette amélioration de l'efficacité de la résolution, en particulier dans les instances du benchmark modifiedRenault [1], telles que renault-mod-4_ext et renault-mod-32_ext. Ces résultats soulignent le potentiel de notre heuristique à faire progresser de manière significative l'état de l'art des méthodologies de résolution de CSP.

**Key words :** Problèmes de satisfaction de contraintes - heuristique - Dècomposition d'arbres.

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# NER in the legal domain : Datasets & Approaches

Marya Bouazabia [a], Faiçal Azouaou [b]

[a] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
[b] Ecole Supérieure en Sciences et Technologies de l'informatique et du Numérique (ESTIN)
Emails : marya.bouazabia@univ-bejaia.dz ; azouaou@estin.dz

**Abstract :** Named Entity Recognition (NER) is a subtask of Natural Language Processing (NLP) that aims to identify specific pieces of information in a given block of unstructured text, such as names of people, organizations, locations, dates, etc., often referred to as entities. NER is crucial for several NLP applications, for instance : question answering, summarization, navigation systems, machine translation and more. Given the importance of the NER task, a multitude of NER datasets have been proposed in the literature. The presentation will shed light on a general taxonomy behind NER datasets and some major ones in the legal domain, along with essential NER techniques and recent contributions in the legal domain.

**Key words :** NER ; Legal domain ; NER Datasets ; Machine learning ; Tranformers ; LLM

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# Modèles LSTM pour la Prédiction des Épisodes d'Hypoglycémie et d'Hyperglycémie dans le Diabète de Type 1

Abdelaziz Mansour [a], Kamal AMROUN [a], Zineb Habbas [b]

[a] LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
[b] LORIA Laboratory, Lorraine University, France
Emails : abdelaziz.mansour@univ-bejaia.dz ; kamal.amroun@univ-bejaia.dz ; zineb.habbas@univ-lorraine.fr

**Abstract :** Ce travail se concentre sur la prédiction des événements indésirables (hypoglycémie et hyperglycémie) chez les patients atteints de diabète de type 1 (DT1), avec un horizon de prédiction (HP) de 30 minutes. Les données utilisées proviennent d ?un ensemble de mesures de glycémie (BG) prises toutes les 5 minutes sur une période de 8 semaines auprès de 12 patients DT1. L ?algorithme appliqué est Long Short-Term Memory (LSTM), connu pour son aptitude à traiter des séquences temporelles complexes de manière efficace. Les modèles sont à sorties multiples, fournissant des prédictions sur des HP de 5, 10, 15, 20, 25 et 30 minutes simultanément, qui sont ensuite combinées pour obtenir la prédiction finale à un HP de 30 minutes. Les résultats obtenus démontrent une capacité appréciable de ces modèles à prédire les événements hypoglycémiques et hyperglycémiques, avec des scores F1 de 0,668 et 0,870 respectivement. Ces résultats sont prometteurs pour la prédiction des épisodes hyperglycémiques, atteignant un niveau comparable à l'état de l'art. Toutefois, des ajustements supplémentaires sont nécessaires pour améliorer la performance du modèle hypoglycémique.

**Key words :** Apprentissage profond ; LSTM, diabète de type 1 ; prédiction des événements glycémiques ; hyperglycémie ; hypoglycémie

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# Recommendation systems in health care

Sirina Mekaouche, Houda Elbouhissi

LIMED Laboratory, Faculty of Exact Sciences, University of Bejaia, 06000 Bejaia, Algeria
Emails : sirina.mekaouche@univ-bejaia.dz ; houda.elbouhissi@univ-bejaia.dz

**Abstract :**

In this presentation, we will introduce the transformative role of recommendation systems in healthcare, showcasing how these tools leverage vast patient dataincluding lifestyle habits, medical history, and real-time health metrics to deliver personalized care. Drawing on familiar examples from streaming, social media, and e-commerce, we will illustrate how recommendation systems provide tailored experiences and explain how these concepts are applied to healthcare to promote better outcomes and healthier lifestyle choices.

We will explore specific healthcare recommendation types, such as systems for food and nutrition that offer dietary advice based on individual profiles, disease diagnosis tools that assess health risks and recommend preventive actions, and physical activity recommendations suited to patients'unique needs. We'll also discuss therapy and medication recommendations that help optimize treatment outcomes. Additionally, we will cover the key technologies behind these systems, including machine learning, deep learning, knowledge-based systems, and hybrid techniques, which together create accurate, relevant recommendations.

Finally, we will address the unique challenges of healthcare recommendation systems, including data privacy, managing new-user data (cold-start issues), and the ethical implications of transparency and accuracy. Our conclusion will summarize the vast potential of these systems to support preventive care and personalized treatment while empowering patients in their own health management. We'll close with a brief overview of our own approach, highlighting the innovations we're contributing to enhance personalized care and patient engagement in healthcare recommendation systems.

**Key words :** Recommender System ; Ontologies ; Machine Learning ; Knowledge ; Collaborative ; Swarm intelligence.

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# Deep Reinforcement Learning for Efficient Inter-Slice RAN Scheduling in 5G Networks

Houssem Eddine Benmadani, Mohamed Azni

LIMED Laboratory, Dept. of Electrical Engineering, Telecommunication, University of Bejaia, 06000 Bejaia, Algeria
Emails : houssemeddine.benmadani@univ-bejaia.dz ; mohamed.azni@univ-bejaia.dz

**Abstract :** With the advent of 5G networks, enabling diverse use cases such as enhanced Mobile Broadband (eMBB), Ultra-Reliable Low Latency Communication (URLLC), and massive Machine-Type Communication (mMTC) requires the efficient utilization of Radio Access Network (RAN) resources. Network slicing plays a pivotal role in addressing these demands by virtually partitioning the RAN into dedicated slices. However, efficient inter-slice scheduling remains a significant challenge due to dynamic traffic patterns and stringent Quality of Service (QoS) requirements.

This presentation explores the potential of Deep Reinforcement Learning (DRL) as a solution for inter-slice RAN scheduling. DRL models, leveraging the combination of neural networks and reinforcement learning, enable adaptive decision-making in complex, dynamic environments. The proposed approach demonstrates how DRL can allocate resources efficiently across slices, ensuring QoS adherence while maximizing overall network throughput and resource utilization.

**Key words :** 5G ; Network slicing ; Scheduling ; Deep Reinforcement Learning ; Radio Access Network Slicing.

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