



OGGETTO : INTEGRAZIONE AL BANDO DI CONCORSO PER L'AMMISSIONE AI CORSI DI DOTTORATO DI RICERCA (XL CICLO a.a. 2024/2025), DR n. 325/2024 Prot. N. 0046909 del 28.06.2024

IL RETTORE

VISTO il regolamento in materia di dottorato di ricerca, emanato con DR n.169/2022;

RICHIAMATO il bando di concorso per l'ammissione ai Corsi di Dottorato di Ricerca XL (a.a. 2024/2025) DR. n. 325/2024 Prot. N. 0046909 del 28.06.2024 e ss.mm.;

VISTO il Decreto del Dirigente del settore Istruzione, Innovazione Sociale e Sport n. 63/IISP del 29/04/2024. PR Marche FSE+ 2021-2027 Asse 4 OS 4a DGR N. 445 del 25/03/2024. Avviso pubblico per l'assegnazione di n.40 borse di ricerca di dottorato innovativo con caratterizzazione industriale a.a. 2024/2025;

VISTO il relativo DDS della Regione Marche n. 109 del 27/06/2024 (Allegato A) recante l'approvazione della graduatoria riguardo l'assegnazione delle borse di studio finanziate dalla Regione Marche;

RITENUTO OPPORTUNO integrare il bando di cui sopra, in particolare in merito all'ANNEX 1, fermi restando i termini per la presentazione delle domande di ammissione originariamente previsti;

DECRETA

Di integrare l'ANNEX 1 come segue:

- inserimento dei progetti di ricerca ammessi in base al DDS della Regione Marche di cui alle premesse;
- nell'ambito dell'accordo sottoscritto fra l'Università degli Studi di Camerino e Liaocheng University (Cina), di riservare fino ad un massimo di n. 5 posizioni sovrannumerarie per cittadini cinesi laureati nell'Università di Liaocheng, per svolgere ricerche preferibilmente su tematiche della Physics, Chemistry, Mathematics, Biology and Veterinary.

Camerino,

Il Rettore

Prof. Graziano Leoni

OBJECT: AMENDMENT of the SELECTION PROCEDURE FOR ADMISSION TO PhD PROGRAMMES (CYCLE 40, Academic Year 2024/2025) Rector's Decree No. 325/2024 Prot. N. 0046909 of 28.06.2024

THE RECTOR

HAVING REGARD to the Regulations on PhD Programmes, issued with Rector's Decree No. 169/2022;

HAVING REGARD to the NOTICE OF SELECTION PROCEDURE FOR THE ADMISSION TO PhD PROGRAMMES (CYCLE 40, Academic Year 2024/2025) Rector's Decree No. 325/2024 Prot. N. 0046909 of 28.06.2024;

SEEN the Decree of the Director of the Education, Social Innovation, and Sports sector no. 63/IISP dated 29/04/2024. PR Marche FSE+ 2021-2027 Axis 4 OS 4a DGR No. 445 dated 25/03/2024. Public notice for the awarding of scholarships for innovative doctorates with industrial characterization for the academic year 2024/2025;

SEEN the relevant DDS of the Marche Region no. 109 dated 27/06/2024 (Annex A) approving the ranking for the awarding of scholarships funded by the Marche Region;

DEEMED APPROPRIATE to proceed with an AMENDMENT of the SELECTION PROCEDURE above mentioned, in particular regarding ANNEX 1, without prejudice to the terms originally scheduled for the submission of applications;

DECREE

The ANNEX 1 is integrated as follows:

- inclusion of the approved research projects based on the DDS of the Marche Region as in the premises;
- As part of the agreement signed between the University of Camerino and Liaocheng University (China), reserve up to a maximum of 5 additional positions for Chinese citizens who graduated from Liaocheng University, to conduct research preferably on topics in Physics, Chemistry, Mathematics, Biology, and Veterinary.

Camerino,

Il Rettore

Prof. Graziano Leoni

ANNEX 1 (ALLEGATO 1) AREAS OF RESEARCH

Further potential positions available in the framework of International mobility agreements with People's Republic of China (Phd Programs for each topic will be identified later)

Positions codes: from "LIAOCHENG 1" to "LIAOCHENG 5"

Type of positions: supernumerary – international mobility Phd Position – without UNICAM scholarship

Up to a maximum of 5 scholarships reserved for Chinese citizens graduated from the Liaocheng University under the agreement signed between the University of Camerino and the Liaocheng University (China), for carrying out research preferably in the field of Physics, Chemistry, Mathematics, Biology, and Veterinary Medicine.

Scholarship code: ARCH3REG



Cofinanziato
dall'Unione europea



Language of the Phd Program: English

PhD Course and curriculum: **Architecture, Design, Planning - Curriculum in Innovation Design**

Leader of the Phd Course: Prof. Gerardo Doti

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: Cluster "IN MARCHE. Creativity Innovation Cluster" and Cosmob S.p.A.

Research Topic (and project):

Design sostenibile e circolare di sistemi di arredo intelligenti con funzione salva-vita in caso di sisma per contesti collettivi

In risposta alla crescente domanda sociale di sicurezza che si è fortemente riaccesa dopo gli eventi sismici che hanno colpito l'Italia nel 2016, il progetto si propone di studiare, sviluppare e prototipare soluzioni innovative, concrete ed efficaci per la protezione delle persone durante un terremoto. Durante un terremoto, i sistemi mobili, gli arredi e le attrezzature, che costituiscono gli ambienti, possono diventare ostacoli e barriere che aggravano le condizioni di pericolo o, al contrario, possono rappresentare una possibilità di sopravvivenza. L'obiettivo del progetto è progettare e prototipare sistemi di arredo "antisismici", "salvavita" in caso di sisma, innovando, da un punto di vista strutturale e attraverso criteri di eco-design, la progettazione degli arredi utilizzati in contesti collettivi, trasformandoli in sistemi di sicurezza passiva che possano contribuire alla salvaguardia della vita delle persone. Il progetto di ricerca intende dare un contributo significativo in termini di innovazione di prodotto, sviluppo economico e crescita della competitività delle aziende marchigiane del settore legno-arredo, definendo e realizzando sistemi di arredo circolari, intelligenti e protettivi durante un terremoto e validandoli attraverso test e prove strutturali.

Sustainable and circular design of intelligent furniture systems for collective contexts with life-saving function during an earthquake

In response to the growing social demand for safety, in public and private buildings, which was strongly rekindled after the seismic events that hit Italy in 2016, the project aims to study, develop and prototype innovative, concrete and effective solutions for the protection of people during an earthquake. During an earthquake, the mobile systems, furniture and equipment that make up environments can become obstacles and barriers that exacerbate dangerous conditions or, on the contrary, can represent a chance for survival. The aim of the project is to design and prototype 'earthquake-proof', 'life-saving' furniture systems in the event of an earthquake, innovating, from a structural point of view and through eco-design criteria, the design of furniture, used in collective contexts, transforming them into passive safety systems that can contribute to safeguarding people's lives. The research project intends to make a significant contribution in terms of product innovation, economic development and increasing of competitiveness of companies in the wood-furniture sector in the Marche region, by defining and implementing circular, intelligent and protective furniture systems during an earthquake and validating them through structural tests and trials.

Supervisor: Prof.ssa Lucia Pietroni

Co-supervisor: Dott. Alessio Gnaccarini

Scholarship funded by the Marche Region under Innovative PhD research scholarships with an industrial characterization for the academic year 2024/2025 - PR Marche FSE+ 2021-2027. Asse 4 OS 4a. DGR n. 445 del 25/3/2024 Avviso Pubblico Decreto n. 63/IISP del 29/4/2024. Assegnazione n. 40 borse di dottorato di ricerca di dottorato innovativo a caratterizzazione industriale.

Duration: 3 years

Starting date: 1st November 2024

ECTS credits (within 3 years): 180

The Doctoral program consists of 180 ECTS credits, distributed in the following way, in order to contribute to a better recognition of your title at a European and global level

- 1 Year:
 - 40 ECTS in research activity (with a yearly evaluation)
 - 10 ECTS in mandatory SAS Activities to acquire transferable skills
 - 10 ECTS in curricular related activities: 7 ECTS for participation in thematic option courses ; 3 ECTS for participation in seminars and events
- 2 Year:
 - 40 ECTS in research activity (with a yearly evaluation)
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- 3 Year:
 - 50 ECTS in research activity (writing and defend the Doctoral dissertation)
 - 10 ECTS in mandatory SAS Activities to acquire transferable skills

The Curricular related activities (seminars and courses in specific topics of interest) are organized by the Scientific Board of the Doctoral course.

Special requirements, additional to "standard" ones:

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application The requirements above mentioned must be met by the candidates at the time of submission of the application for participation in this call for applications.

- Mandatory Period of research mobility abroad: at least 6 months
- Further mandatory period of research and training mobility for the scope of the research topic (in Italy): period to be defined at the premises of the involved companies and Clusters of Marche Region

Further aspects related to this topic must comply with the project the position is based on.

Scholarship code: CHEM10REG



Language of the Phd Program: English

PhD Course and curriculum: **CHEMICAL AND PHARMACEUTICAL SCIENCES AND BIOTECHNOLOGY-
curriculum PHARMACEUTICAL, NUTRACEUTICAL AND FOOD SCIENCES**

Leader of the Phd Course: Prof. Claudio Pettinari

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: Enereco S.p.A., Algaria srl

Research Topic and project: **Titolo: Astaxantina da microalghe: sviluppo e formulazione di prodotti innovativi ed ecosostenibili per i settori farmaceutico, cosmetico e nutraceutico.**

L'obiettivo di questo progetto è quello di sviluppare prodotti innovativi a base di astaxantina partendo da una ricerca approfondita sullo stato attuale dei formulati commerciali e di interesse nei settori farmaceutico, cosmetico e nutraceutico. L'astaxantina è una molecola nota per l'elevato potere antiossidante oggetto di numerosi studi per i potenziali effetti sul sistema immunitario, sulla pelle, a livello oculare e cardiovascolare. Questa ricerca si concentrerà, quindi, inizialmente sull'analisi chimico-fisico e formulativa di prodotti già esistenti, allo scopo di valutarne l'efficacia e le potenziali applicazioni per la salute umana e, successivamente, di apportare innovatività nell'approccio formulativo allo scopo di migliorare biodisponibilità ed efficacia della molecola oggetto del progetto. Inoltre, verranno esaminati i processi di estrazione più efficienti per ottenere astaxantina dalla biomassa algale, al fine di identificare le metodologie più vantaggiose dal punto di vista economico e qualitativo.

Title: Astaxanthin from Microalgae: Development and Formulation of Innovative and Eco-Sustainable Products for the Pharmaceutical, Cosmetic, and Nutraceutical Sectors

The objective of this project is to develop innovative products based on astaxanthin starting from an in-depth research on the current state of commercial formulations in the pharmaceutical, cosmetic, and nutraceutical sectors. Astaxanthin is a molecule known for its high antioxidant properties and has been the subject of numerous studies on the immune system, skin, eyes, and cardiovascular health. Therefore, this research will initially focus on the chemical-physical and formulation analysis of existing products, in order to evaluate their effectiveness and potential applications for human health. Subsequently, the research will aim to bring innovation in the formulation approach to improve the bioavailability and effectiveness of the molecule in question. Additionally, the most efficient extraction processes for obtaining astaxanthin from algal biomass will be examined, with the goal of identifying the most economically and qualitatively advantageous methodologies.

Supervisor: Prof.ssa Giulia Bonacucina
Co-supervisor: Prof. Luca Casettari

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Duration: **3 years**

Starting date: **1st November 2024**

ECTS credits (within 3 years): 180

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 - 40 ECTS in research activity (with a yearly evaluation)
 - 10 ECTS in mandatory SAS Activities to acquire transferable skills
 - 10 ECTS in curricular related activities: 7 ECTS for participation in thematic option courses ; 3 ECTS for participation in seminars and events
- 3 Year:
 - 50 ECTS in research activity (writing and defend the Doctoral dissertation)
 - 10 ECTS in mandatory SAS Activities to acquire transferable skills

The Curricular related activities (seminars and courses in specific topics of interest) are organized by the Scientific Board of the Doctoral course.

Special requirements, additional to "standard" ones:

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-Mandatory Period of research mobility abroad: at least 6 months

-Further mandatory period of research and training mobility for the scope of the research topic (in Italy): period to be defined at the premises of the involved companies and Clusters of Marche Region

Further aspects related to this topic must comply with the project the position is based on.

Scholarship code: CHEM11REG



Language of the Phd Program: English

PhD Course and curriculum: **Chemical and Pharmaceutical Sciences and Biotechnologies, curriculum Chemical Sciences**

Leader of the Phd Course: Prof. Claudio Pettinari

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: Prof. Marcello Cabibbo, Marche Polytechnic University and MARLIC Laboratory of Camerino

Research Topic and project: **Caratterizzazione e riciclo chimico dei materiali tecnici per uno sviluppo sostenibile dei processi industriali.**

Characterization and chemical recycling of composite materials for a sustainable development of industrial process.

During the doctoral course the student will have the opportunity to develop innovative polymer matrix composite materials of both academic and industrial interest. Through the opportunity to use instruments available at the Marlic Laboratory, the student will find itself in a position to use chemical methodologies in solving real problems such as the sustainability of industrial processes of reuse, recycling, and biodegradability of materials. Significant portion of the work is devoted to the application of chemistry in being able to use bio-based and thermosetting materials, and avoid their combustion or incineration. The objective of the course is to meet the needs of manufacturing production for chemical recycling to be obtained using small molecules with and without catalytic systems.

Supervisor: Prof. Claudio Pettinari

Co-supervisors: Prof. Enrico Marcantoni and Prof. Marcello Cabibbo

Scholarship funded by the Marche Region under Innovative PhD research scholarships with an industrial characterization for the academic year 2024/2025 - PR Marche FSE+ 2021-2027. Asse 4 OS 4a. DGR n. 445 del 25/3/2024 Avviso Pubblico Decreto n. 63/IIISP del 29/4/2024. Assegnazione n. 40 borse di dottorato di ricerca di dottorato innovativo a caratterizzazione industriale.

Duration: **3 years**

Starting date: **1st November 2024**

ECTS credits (within 3 years): 180

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- 10 ECTS in curricular related activities: 7 ECTS for participation in thematic option courses ; 3 ECTS for participation in seminars and events
- 2 Year:
 - 40 ECTS in research activity (with a yearly evaluation)
 - 10 ECTS in mandatory SAS Activities to acquire transferable skills
 - 10 ECTS in curricular related activities: 7 ECTS for participation in thematic option courses ; 3 ECTS for participation in seminars and events
- 3 Year:
 - 50 ECTS in research activity (writing and defend the Doctoral dissertation)
 - 10 ECTS in mandatory SAS Activities to acquire transferable skills

The Curricular related activities (seminars and courses in specific topics of interest) are organized by the Scientific Board of the Doctoral course.

Special requirements, additional to "standard" ones:

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Further aspects related to this topic must comply with the project the position is based on.

Scholarship code: CHEM12REG



Language of the Phd Program: English

PhD Course and curriculum: **Chemical and Pharmaceutical Sciences and Biotechnology; curriculum Pharmaceutical, Nutraceutical and Food Sciences**

Leader of the Phd Course: prof. Pettinari Claudio

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: AST Macerata, Ospedale di Civitanova Marche; Ospedale Santa Maria La Gruccia (Montevarchi, Arezzo); AOUI Verona; VRAI Vision Robotics & Artificial Intelligence Lab; Institut Polytechnique de Paris.

Research Topic and project:

Titolo: Applicazione dell'Intelligenza Artificiale in Urologia funzionale: potenziamento della diagnostica e del trattamento.

Progetto: Attraverso la collaborazione tra università, P.O. e aziende tecnologiche del territorio, il progetto si prefigge di formulare strategie diagnostico-terapeutiche che possano supportare la pratica clinica nell'ambito della ritenzione urinaria e dell'ipocontrattilità detrusoriale.

Title: Application of Artificial Intelligence in Functional Urology: enhancement of diagnostics and treatment.

Project: Through the collaboration between universities, P.O. and local technology companies, the project aims to formulate diagnostic-therapeutic strategies that can support clinical practice in the field of urinary retention and detrusorial hypocontractility.

Supervisor: MARIA BEATRICE MORELLI

Co-supervisor: EMANUELE FRONTONI

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Duration: 3 years

Starting date: 1st November 2024

ECTS credits (within 3 years): 180

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 - 40 ECTS in research activity (with a yearly evaluation)
 - 10 ECTS in mandatory SAS Activities to acquire transferable skills
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- 3 Year:
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Special requirements, additional to "standard" ones:

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-Mandatory Period of research mobility abroad: at least 6 months

-Further mandatory period of research and training mobility for the scope of the research topic (in Italy): period to be defined at the premises of the involved companies and Clusters of Marche Region

Further aspects related to this topic must comply with the project the position is based on.

Scholarship code: CHEM13REG



Language of the Phd Program: English

PhD Course: **Chemical and Pharmaceutical Sciences and Biotechnology; curriculum: Pharmaceutical, Nutraceutical and Food Sciences**

Leader of the Phd Course: Claudio Pettinari

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: CNR-IRBIM Ancona; Cluster Agrifood Regionale

Research Topic and project: **Sostenibilità ed Economia Circolare: End of Waste, Blue Economy e trasformazione degli scarti agroalimentari.**

L'Economia Circolare è al centro delle politiche europee e vede l'Italia prima tra gli Stati Membri per indice di circolarità. L'integrazione tra Economia Circolare e Blue Economy promuove la sostenibilità tra i vari settori che operano tra il mare e la costa, ottimizzando l'uso delle risorse naturali e riducendo gli impatti antropici; conserva gli ecosistemi, promuove tecnologie innovative per il riciclo delle risorse e crea comunità più resilienti. Il progetto mira a sviluppare e promuovere attività di ricerca in collaborazione non solo con gli enti di ricerca ma anche con le realtà imprenditoriali di tutto il settore agroalimentare andando a formare il/la dottorando/a allo studio e alla valorizzazione degli scarti agricoli applicando i principi della Bioeconomia. Il progetto si propone di dare un contributo effettivo alla riduzione dei rifiuti in ambito terrestre e marino andando a garantire un Buono Stato Ambientale e sviluppando una catena di valore regionale.

Circular Economy and Sustainability: End of Waste, Blue Economy and reuse of Food Waste

Circular Economy is at the center of European policies and sees Italy first among the Member States in terms of circularity index. The integration between Circular Economy and Blue Economy promotes sustainability among the various sectors that operate between sea and coast, optimizing the use of natural resources and reducing anthropogenic impacts; conserves ecosystems, promotes innovative technologies for recycling resources and creates more resilient communities. The project aims at developing and promoting research activities in collaboration not only with research institutions but also with business entities throughout the agri-food sector, by training the PhD student in the study and valorization of agricultural waste, by applying the principles of the Bioeconomy. The project aims to make an effective contribution to the reduction of land and marine waste by guaranteeing a Good Environmental Status and developing a regional value chain.

Supervisor: Sauro Vittori (Unicam)

Co-supervisors: Mauro Marini (CNR-IRBIM, Ancona), Germana Borsetta (Unicam)

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Duration: **3 years**

Starting date: **1st November 2024**

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Special requirements, additional to "standard" ones:

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-Further mandatory period of research and training mobility for the scope of the research topic (in Italy): period to be defined at the premises of the involved companies and Clusters of Marche Region

Further aspects related to this topic must comply with the project the position is based on.

Scholarship code: COMP9REG



Language of the Phd Program: English

PhD Course and curriculum: **COMPUTER SCIENCE AND MATHEMATICS**

Leader of the Phd Course: Prof. Andrea Polini

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: UNIVPM, Imperial College-London, INGP Grenoble, i-LABS Industry, Lu.Ce., MECCANO

Research Topic and project: **SIMBA (Energia, in lingua Shona)**

Energia, Prognostica, Blockchain, sistemi embedded tamper-proof

Focus del progetto è la realizzazione di un modello di servitizzazione di manutenzione predittiva/prognostica per dispositivi elettrici, multidominio e indipendente dal livello di smartizzazione degli stessi. Il servizio dovrà essere indipendente dalla specificità del dispositivo monitorato e verrà associato ad un device tamper-proof (con hw e sw non manomissibili), anch'esso sviluppato nel progetto, per il monitoraggio quantitativo e qualitativo del consumo energetico, con memorizzazione dei dati e delle logiche applicative in Blockchain. L'astrazione dalla specificità del dispositivo monitorato renderà il servizio applicabile sia in ambito industriale (a macchine di produzione non smart che fanno comunque parte del parco macchine in uso e che non possono essere rese 4.0 se non con alti costi) sia negli ambienti di vita (a elettrodomestici vari). La veridicità dei dati acquisiti e degli output delle predizioni verrà garantita non solo nella fase di storage (perché memorizzati in Blockchain, e quindi non manomissibili) ma anche in fase di generazione alla sorgente (grazie alla non manomissibilità dello strumento di acquisizione).

The focus of the project is the creation of a multi-domain and device-independent predictive/prognostic maintenance servitisation model for electrical devices.

The service must be independent of the specificity of the monitored device and will be associated with a tamper-proof device, also developed in the project, for the quantitative and qualitative monitoring of energy consumption, with data storage and application logics in Blockchain.

The abstraction from the specificity of the monitored device will make the service suitable both for the industrial sector (to non-smart production machines which are still part of the fleet of machines in use and which cannot be equipped with sensors with low costs) and in living environments (to various household appliances). The truthfulness of the acquired data and the prediction outputs will be guaranteed not only in the storage phase (because they are stored in Blockchain, and therefore are not tamperable) but also in the data generation phase at the source (thanks to the non-tampering nature of the acquisition tool).

Supervisor: Prof.ssa Diletta Romana Cacciagrano

Co-supervisor: Prof. Michele Germani

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Scholarship code: COMP10REG



Language of the Phd Program: English

PhD Course and curriculum: **COMPUTER SCIENCE AND MATHEMATICS**

Leader of the Phd Course: Prof. Andrea Polini

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student:

- University of Applied Sciences and Arts Northwestern (FHNW): Prof. Knut Hinkelmann.
- Universitat Politècnica de València (UPV): Prof. Valderas Aranda Pedro José.
- Laboratory of Intelligent Systems, University of Maribor (UM): Prof. Sašo Karakatič.
- University of Uhtrecht: Prof. Claudio di Ciccio.
- SIGMA Spa; azienda sita in via dell'industria, 19 - Monterubbiano Fermo.
- ALCI s.r.l.: azienda sita in via Mutilati del Lavoro, 105 63100, Ascoli Piceno Ascoli Piceno.
- MAC Sr.: Azienda con sede in Via XX Settembre, 23, 62019 Recanati MC.
- Cluster Marche Manufacturing.

Research Topic and project:

Design and Development of a Trusted Digital Twin Prototype for Industrial Manufacturing

Il progetto di dottorato riguarda la definizione di un sistema di modellazione, monitoraggio e ottimizzazione di sistemi cyber-fisici (CPS) attraverso l'uso della tecnologia Digital Twin (DT) e di Intelligenza Artificiale (AI) in ambiente Trusted. L'ambito di applicazione riguarda macchinari a forte impatto energetico e per l'ambiente, sia in ambito industriale che civile come, ad esempio, decanter per la purificazione delle acque reflue, lavorazione del metallo, i sistemi di controllo della produzione e degli scarti, sistemi per servizi.

Il DT permetterà di modellare la macchina reale con il corrispettivo gemello digitale nel mondo virtuale, riducendo il gap tra situazione reale e quella osservata. L'AI supporterà la simulazione basata sulle condizioni operative reali, proponendo strategie di miglioramento continuo dei parametri di processo (risparmio energia, qualità di lavorazione, etc.). Il DT permetterà di applicare le ottimizzazioni sul sistema reale sia in modalità semi-automatica con la supervisione dell'operatore, sia in modalità automatizzata.

La Blockchain promuoverà nuovi modelli di gestione decentralizzata dei dati del CPS e delle ottimizzazioni, abilitando nuovi modelli di business incentrati sul trust e trasparenza nella contrattualizzazione dei canoni di servizio per il cliente finale.

Design and Development of a Trusted Digital Twin Prototype for Industrial Manufacturing

The project aims to define a system for modeling, monitoring, and optimizing cyber-physical systems (CPS) using Digital Twin (DT) technology and Artificial Intelligence (AI) in a trusted environment. The scope of application includes machines with significant energy and environmental impacts, in both industrial and civil settings, such as decanters for wastewater purification, metal processing, production control, waste management systems, and service systems. The DT will model the real machine with its corresponding digital twin in the virtual world, reducing the gap between the real and observed situations. AI will support simulations based on real operating conditions, proposing strategies for the continuous improvement of process parameters (e.g., energy savings, processing quality). The DT will enable the application of optimizations to the real system in both semi-automated mode, with operator supervision, and fully automated mode. Blockchain technology will promote new models of decentralized data management for CPS and optimizations, enabling innovative business models centered on trust and transparency in the contractualization of service fees for the end customer.

Supervisor: Andrea Morichetta

Scholarship funded by the Marche Region under Innovative PhD research scholarships with an industrial characterization for the academic year 2024/2025 - PR Marche FSE+ 2021-2027. Asse 4 OS 4a. DGR n. 445 del 25/3/2024 Avviso Pubblico Decreto n. 63/IISP del 29/4/2024. Assegnazione n. 40 borse di dottorato di ricerca di dottorato innovativo a caratterizzazione industriale.

Duration: **3 years**

Starting date: **1st November 2024**

ECTS credits (within 3 years): 180

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Scholarship code: PHYS_MAT_EARTH_6_REG



Language of the Phd Program: English

PhD Course: **PHYSICS, EARTH AND MATERIALS SCIENCES, curriculum MATERIALS SCIENCES**

Leader of the Phd Course: Roberto Gunnella

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: Simonelli Group SPA, UNIMC

Titolo: Tecniche di controllo per la percolazione del caffè

Progetto: Il caffè è la bevanda più consumata al mondo dopo acqua e latte; questo comporta un indotto commerciale di dimensione simile a quelli di petrolio e acciaio. Gli attori che operano in tale settore sono quindi alla continua ricerca di innovazioni del prodotto e dei servizi offerti per aumentare la loro competitività.

Il presente progetto è dedicato allo studio della percolazione del caffè espresso (CE), che è il processo fisico-chimico alla base della preparazione del caffè. La formulazione matematica di tale processo permette, a partire dalle condizioni estrattive, di predire la composizione chimica della bevanda e quindi le sue proprietà nutritive e organolettiche. In particolare, lo scopo del progetto è di studiare tecniche per calcolare le condizioni estrattive che ottimizzano la proprietà nutritive ed organolettiche del CE in base alle richieste del consumatore. La ricerca scientifica proposta in questo progetto va ben al di là dello stato dell'arte e permetterà ai partner industriali coinvolti di acquisire un posizionamento strategico nel panorama mondiale dell'industria del caffè.

Research Topic and project: Control techniques for coffee percolation

Coffee is the most consumed drink in the world after water and milk; this leads to a commercial industry of a similar size to that of oil and steel. The players who operate in this sector are therefore continuously looking for innovations in the product and services offered to increase their competitiveness. This project is dedicated to the study of espresso coffee percolation (EC), which is the physical-chemical process underlying the preparation of coffee. The mathematical formulation of this process allows, starting from the extraction conditions, to predict the chemical composition of the drink and therefore its nutritional and organoleptic properties. In particular, the aim of the project is to study techniques to calculate the extraction conditions that optimize the nutritional and organoleptic properties of CE based on consumer requests. The scientific research proposed in this project goes well beyond the state of the art and will allow the industrial partners involved to acquire a strategic positioning in the global panorama of the coffee industry.

Supervisor: Pierluigi Maponi

Co-supervisor: Emanuele Frontoni (UNIMC)

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Scholarship code: LEGAL 5 REG



Language of the Phd Program: English

PhD Course and curriculum: **Legal and Social Sciences – Curriculum “Civil Law and Constitutional Legality”**

Leader of the Phd Course: Prof. Carlotta Latini

Lead Partner of the PhD Program: University of Camerino (UNICAM)

Partners and possible operative sites of the Phd Student: Regione Marche -UNIVPM – UNIURB - Socen s.r.l.- IN MARCHE. Creativity Innovation Cluster

Research Topic and project: **Regole ESG, materiali sostenibili come fattore di innovazione della produzione della scarpa – ESG-Scarpa**

Il mercato calzaturiero è oggetto di regolamentazioni e standardizzazioni di livello internazionale ed europeo orientate alla trasformazione del mercato della moda e della persona in chiave sostenibile. **Scopo del progetto** è aiutare le filiere marchigiane, a “giocare in anticipo” utilizzando i nuovi quadri regolatori ESG per contribuire alla ripresa di un comparto determinante per l’economia della Regione. Il progetto unisce competenze giuridiche (UNICAM), economiche (UNIVPM) e sociologiche (UNIURB) e Cluster IN MARCHE ponendo al centro dell’attività la figura del contoterzista, PMI con importante ruolo di innovatore della filiera in chiave eco-sostenibile. Il giovane dottorando beneficerà di un eco-sistema formativo intersettoriale e grazie allo stage in azienda contoterzista potrà sviluppare conoscenze dei bisogni, cogliere opportunità di innovazione coniugando il tutto in funzione di possibili certificazioni. Il progetto risponde alle indicazioni contenute nella recentissima Direttiva CDDD che raccomanda una redazione di clausole contrattuali di filiera orientate alla sostenibilità con protezione degli interessi anche dei contoterzisti nelle relazioni B2B del mercato della calzatura. **Risultati del progetto** sono lo sviluppo di modelli contrattuali adatti, la delineazione di linee guida per iter di certificazione, il trasferimento circolare delle informazioni giuridiche all’interno di imprese interessate al progetto e debitamente coinvolte fin dall’avvio dello stesso. (IT)

ESG rules, sustainable materials as innovative factor of the shoe

The Footwear Market is subject to international and European regulations and standardizations oriented to the transformation of the fashion and personal market in a sustainable way. The aim of the project is to help the supply chains of the Marche region to "play in advance" by using the new ESG regulatory frameworks to contribute to the recovery of a sector that is crucial for the Region’s economy. The project combines legal skills (UNICAM), economic (UNIVPM) and sociological (UNIURB) and Cluster IN MARCHE putting at the center of the activity the figure of contractor, SMEs with an important role of innovation in the eco-sustainable. The young PhD student will benefit from a cross-sector eco-training system and thanks to the internship in the contractor company will be able to develop knowledge of needs, seize opportunities for innovation by combining everything according to possible certifications. The project responds to the indications contained in the recent CDDD Directive that recommends the drafting of contractual clauses of the supply chain

oriented to sustainability with protection of the interests of contractors in the B2B relations of the Footwear Market. The results of the project are the development of suitable contractual models, the delineation of guidelines for certification procedures, the circular transfer of legal information within undertakings involved in the project and duly involved since its inception.

Supervisor: Prof. Lucia Ruggeri – lucia.ruggeri@unicam.it

Co-supervisors: Prof. Michele Cucculelli -UNIVPM; Prof. Angela Genova - angela.genova@uniurb.it

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