Decree of the Rector n. 1166 of 13/11/2023

Competition for awarding 1 research grant at the University of Udine

DISCLAIMER:
The official and legally binding call for applications is in Italian only. This document cannot be used for legal purposes and is only meant to provide information in English on the call for applications (Decree of the Rector n. 1166 of 13/11/2023). Please refer to the official call published on: https://www.uniud.it/it/albo-ufficiale

Any change and integration will be made available on the above mentioned web page. Therefore, no personal written communication regarding the examination date and/or competition results shall be provided to applicants.

Annex 1

Competition Notice for the award of 1 research grant for carrying out research activities at the University of Udine on the following subject: “Machine Learning, Prediction, Interpretation, and Integration of Runtime Verification and Machine Learning” SSD: INF/01 (principal investigator, Angelo Montanari).

Research fellowship financed with the resources of the research project titled “Interconnected Nord-Est Innovation Ecosystem” (iNEST). Public call No. 3277 of 30/12/2021, PNRR M4C2 Inv. 1.5, CUP G23C22001130006.

Art. 1

A selection procedure is hereby announced for the award of 1 research grant at the University of Udine, as identified in Attachment A which constitutes an integral and substantial part of this call. The research grant is linked to the research project and is subject and conditioned upon the relative funding. Specifically, the project is placed within the context of the Italian National Recovery and Resilience Plan (i.e., PNRR) – Mission 4: Education and research, Component 2: From research to business, Investment 1.5: Creating and strengthening "innovation ecosystems", building "local R&D leaders", funded by the EU-Next GenerationEU; Project: "Interconnected Nord-Est Innovation Ecosystem" (iNEST), ECS00000043; Thematic area: Digital, Industry, Aerospace. CUP: G23C22001130006.

The fellowship may be renewed, in compliance with Art. 22, Law No. 240 of 30 December 2010 (as in the text in force before the implementation of the Conversion Law of the D.L. 36/2022, L. 79/2022), Law No. 11 of 27 February 2015, and the current regulations of the University of Udine for awarding research grants, issued with the Rector’s Decree No. 182 of 31 March 2021. The renewal is subject to the scientific coordinator’s positive assessment of the researcher’s activities, an adequate scientific rationale, and a corresponding financial covering.

The activities pertaining to this research fellowship will be monitored for compliance with the PNRR’s Do No Significant Harm principle (hereinafter DNSH), that is, they will not cause significant harm to the environment.
This call guarantees equal generational, gender and territorial opportunities.

The research findings resulting from the fellowship, as well as the related data, will be published in compliance with the Open Science and FAIR Data principles.

The research fellowship does not give rise to any right with regards to accessing University posts.

The signing of the contract is subject to the formalization of the agreement between the Hub and Spokes and between Spokes and Spokes’ Affiliates.

Any personal communication to candidates related to this selection will be sent exclusively to the email address indicated when registering for the selection, as mentioned in Art. 5.

Art. 2

The research grant described in this competition announcement and the required qualifications to apply for the position are identified in Attachment A. The lack of the admission requirements leads to the automatic exclusion from the competition procedure.

Possession of a PhD or equivalent degree obtained abroad or, only for the interested areas, of a medical specialization accompanied by an adequate scientific production, constitutes a preferential qualification for awarding the research fellowship of this selection, if it has not been provided as a mandatory requirement.

For the only purpose of the admission to the competition, the Examining Board (Art. 7) shall assess the equivalence of the qualification obtained abroad, except for the evaluation of the medical specialization qualification to which Article 38 of the Legislative Decree 165/2001 and subsequent modifications and additions, and EU regulations on the matter, shall be applied.

The Examining Board will proceed to the evaluation of the qualification obtained abroad according to the documentation attached to the application form. The Examining Board may exclude the candidate if the submitted documentation does not provide sufficient information for the assessment. Therefore, applicants must enclose all the documentation in their possession relating to their qualification in order to provide the Examining Board with sufficient information for assessment.

Candidates holding a qualification issued by a European Research Area country, if successful, must submit, if not already attached to the application form one of the following options:
- Supplement Diploma in English issued by the competent University.
- CIMEA Certificate of comparability of the foreign qualification, issued by CIMEA (Information Centre on Academic Mobility and Equivalence) via the "diplome" service at https://cimea.diplo-me.eu/udine/#/auth/login

Candidates holding a qualification issued by a non-European Research Area country, if successful, must submit, if not already attached to the application form one of the following options:
- Declaration of the on-site value of the qualification and the certificate relating to the degree with examinations and grades. A certificate in a language other than Italian or English must be accompanied by an official translation into one of these languages (certified by the competent diplomatic-consular authority or certified by a court in Italy).
- CIMEA Certificate of comparability of the foreign qualification, issued by CIMEA (Information Centre on Academic Mobility and Equivalence) via the "diplome" service at https://cimea.diplo-me.eu/udine/#/auth/login
If the Supplement Diploma or the statement/attestation of comparability are not available when signing the contract, the applicant must demonstrate that he/she has requested the documentation and submit it as soon as possible.

Any exclusion from the selection procedure due to lack of eligibility requirements, absence of required documents, failure to sign the selection application or submission of the selection application in a manner different from what is provided for in this call for applications will be communicated to applicants exclusively at the email address indicated in the application form.

Art. 3
The research grant referred to in this call for applications cannot be awarded:

a. to employees of Universities and the entities referred to in Article 22, section 1, of Italian Law no. 240 of 30 December 2010 (in the text prior to the reform introduced by Law no. 79 of 29 June 2022);

b. to those who have already been awarded research grants pursuant to Italian Law no. 240 of 30 December 2010 (prior to the reform introduced by Law no. 79 of 29 June 2022) for the maximum period provided by law, even if not continuously, excluding the period in which the grant was used in conjunction with the doctorate, up to the legal term of the relative course;

c. to those who have already benefited from research grants and fixed-term researcher contracts provided for, respectively, in Articles 22 and 24 of Italian Law no. 240 of 30 December 2010 (in the text prior to the reform introduced by Law no. 79 of 29 June 2022), for a total of 12 years, even if not consecutive;

d. to anyone who has a degree of kinship or affinity, up to and including the fourth degree, with:
   - the Rector, the Director General or a member of the Board of Directors of the University of Udine;
   - the scientific supervisor or a professor/researcher belonging to the department or organisation hosting the research grant in question.

The research grant provided for in this call for applications cannot be combined:

a) with scholarships of any kind, except for those granted by Italian or foreign institutions to supplement, by means of stays abroad, the fellow's training or research activities;

b) with other research grants;

c) with an employment relationship, even if part-time, without prejudice to the relevant provisions for employees of public administrations.

The grant awarded under this call for applications is also incompatible with simultaneous attendance at university degree courses, either Bachelors, specialist or Masters, research Doctorates with scholarships and medical specializations, in Italy or abroad.

Art. 4
Applicants must enclose with their application, under penalty of exclusion, the following documents:

a) their professional scientific CV, highlighting the candidate’s aptitude for carrying out and implementing the research project (Attachment A);

b) their identity card, their passport or any other identification document¹;

c) (for candidates with a foreign qualification only) certification or self-certification of both the academic qualification required for the admission to the selection, and of the exams (with

¹ Please be aware that the residence permit is not an identification document.
evaluation) took during the period of study abroad, and of any other document that can be useful to the evaluation of the degree by the Examining Board.

Applicants can attach to the application, publications and any other certification considered useful to demonstrate the qualification based on the research program (Attachment A) and to certify any research activity accomplished at public or private institutes (indicating the starting and ending date and the duration).

The documents and qualifications mentioned above must be submitted in Italian or English. Those that are not as requested will not be evaluated. Documents originally written in a language other than Italian or English must come with a translation in Italian or English, that the candidate will do on its own responsibility. The translation can be an abstract concerning the thesis.

Italian and Community candidates wishing to submit qualifications referring to conditions and facts attested by Public Administrations must proceed exclusively with self-certification.

Non-EU citizens legally residing in Italy may self-certify only data that can be verified or certified by Italian public bodies. They may also use declarations in lieu when provided for by an international convention between Italy and the declarant's country of origin.

Non-EU citizens not residing in Italy cannot self-certify.

Only the qualifications possessed by the candidate on the date the application form is submitted and submitted in accordance with the procedures set out in Article 5 will be assessed.

Failure to submit mandatory documents provided for in this article will constitute grounds for exclusion from the selection.

Art. 5
The submission of the applications for the present call starts on November 16, 2023 at 2:00 pm (Italian time) and ends on December 5, 2023 at 2:00 pm (Italian time).

The application to take part in the selection must be completed, under penalty of exclusion, using the appropriate online procedure, available at the link https://pica.cineca.it/

The procedure involves an applicant registration step, for those who do not already have an account, and then an application completion step.

Once completed, the online application must be signed in the manner described in the online procedure (manual signature with attached identity document or digital signature), under penalty of exclusion from selection. The application does not have to be signed if you access the above-mentioned online procedure using your SPID ID.

The qualifications referred to in Article 4 must be attached to the application in .pdf format. Individual .pdf files may not exceed 30MB.

The application for participation in the selection is automatically sent to the University of Udine with the definitive closing of the online procedure.

The University Administration:
- is not responsible if it is impossible to read the submitted documentation in electronic format due to damaged files;
shall not accept or take into consideration qualifications or documents received in paper form or by any means other than what is specified in this article.

Reference to documents or publications already submitted in connection with other competitions is not allowed.

The Administration is not responsible for any missing document or communication because of inaccurate indication of residence and/or address submitted by the candidate during the application. Also, the Administration is not responsible if the candidate has not communicated changes in this information, or has communicated them too late. The Administration is also not responsible for any postal or telegraphic problems not attributable to the Administration itself.

Applicants are advised not to wait until the last few days before the closing date to submit their application. The University accepts no responsibility for any malfunctions due to technical problems and/or overloading of the communication line and/or application systems.

Art. 6

The selection procedure is held in accordance with the modality indicated in Attachment A.

The test will aim to assess the general preparation, experience and aptitude for research of the candidate. It will consist in the evaluation of the professional scientific curriculum, of the publications and qualifications presented, and of the interview, where foreseen.

Art. 7

The Examining board for the competition is identified in Attachment A of the present competition announcement, of which it is an integral part.

At its first meeting, the Examining board shall appoint its President and Secretary, and establish the criteria and methods for evaluating the qualifications and the interview, where foreseen.

The results of the qualifications assessment must be disclosed to applicants during the interview, where foreseen.

The Examining board can award a maximum of 100 points (one hundred out of one hundred) to the selection.

At the end of the evaluation procedure, the Examining board shall formulate the general merit list based on the overall score of each candidate, and draw up the minutes of the whole competition procedure.

Based on the ranking list, the assignment is awarded to candidates who have obtained a minimum overall score of 70/100 (seventy out of one hundred).

The Examining board's judgement is final.

The ranking list will be made public exclusively through publication on the University's official website.

Applicants will not be notified of the outcome of the evaluation.
Those who do not declare their acceptance of the research grant and do not present themselves at the research centre within the deadline communicated by the latter, even if not formally, shall lose the right to receive it. Exceptions to this term will only be granted in cases of documented force majeure.

**Art. 8**

The research activity cannot be started before signing the contract defining the terms and conditions of the collaboration.

The activity covered by the research grant must have the following characteristics:

- a) it must be carried out as part of the research programme covered by the grant and not be a merely technical support to it;
- b) it must have a close connection with the realization of the research program for which the winner of the grant has been awarded the contract;
- c) it must be continuous and, in any case, temporally defined, not merely occasional, and in coordination with the overall activity of the University;
- d) it must be carried out autonomously, solely within the limits of the programme prepared by the programme supervisor, without predetermined working hours.

The researcher is required to submit a detailed written report on the work carried out and the results achieved, accompanied by the opinion of the scientific supervisor, to the reference organisation at the intervals set out in the contract. The researcher must also submit interim reports and timesheets, if requested by the reference organisation.

Either the fellow or the reference organisation may withdraw from the contract.

The reference organisation may terminate the contract not only in the cases referred to in Article 9, sections 2 and 3, of the "Internal rules for awarding research grants pursuant to law 240 of 30 December 2010" of the University of Udine, but also in the event the research project and therefore the financial coverage on which the research grant is based cease to exist.

The signing of the contract is subject to the formalization of the agreement between the Hub and Spokes and between Spokes and Spokes’ Affiliates.

**Art. 9**

The following legal dispositions shall apply to the grant referred to in this call for applications:
- for tax matters, the provisions of Article 4 of Italian Law no. 476 of 13 August 1984, as subsequently amended and supplemented;
- for social security matters, the provisions of Article 2(26) et seq. of Italian Law no. 335 of 8 August 1995, as subsequently amended and supplemented;
- for mandatory maternity leave, the provisions of the Italian Ministerial Decree of 12 July 2007;
- with regard to sick leave, the provisions of Article 1(788) of Italian Law no. 296 of 27 December 2006 and subsequent amendments.

During the period of mandatory maternity leave, the allowance paid by INPS according to Art. 5 of the Italian Ministerial Decree of 12 July 2007 is supplemented by the University up to the full amount of the research grant.

The grant will be paid in monthly instalments.
Art. 10
The data collected as part of the procedure referred to in Art. 5 are necessary to properly manage the selection procedure, for any subsequent management of the research grant and for purposes related to managing services provided by the University. The University of Udine is the Data Controller. At any time, the data subject may request access, rectification and, depending on the University’s institutional purposes, cancellation and restriction of processing or oppose the processing of their data. The data subject can always lodge a complaint with the Italian Data Protection Authority. The complete disclosure is available on the University of Udine website in the "Privacy" section, accessible from the home page www.uniud.it Direct Link: https://www.uniud.it/it/pagine-speciali/guida/privacy

Art. 11
For all matters not expressly mentioned in this call for applications, refer to the regulations in force on the subject cited in the introduction and to the "Internal rules for awarding research grants pursuant to Italian Law no. 240 of 30 December 2010" of the University of Udine, issued by Rector’s Decree no. 182 of 31 March 2021.

Art. 12
The procedure supervisor is Dr Sandra Salvador, Head of the Research Services Area of the University of Udine. The Responsible office at the University of Udine is “Area Servizi per la Ricerca - Ufficio Formazione per la Ricerca”, via Mantica n. 31 - 33100 Udine, Italia.

To request information about the call for applications, please complete the following form available on the University of Udine website:
https://helpdesk.uniud.it/SubmitSR.jsp?type=req&accountId=universityofudine&populateSR_id=42105
Attachment A

Responsabile scientifico della ricerca / Principal investigator:

Nome e cognome / Name and surname: Angelo Montanari
Qualifica / Position: Professore Ordinario / Full Professor
Dipartimento / Department: Scienze Matematiche, Informatiche e Fisiche (DMIF) / Mathematics, Computer Science and Physics
Area MUR / Research field: 01 – Scienze matematiche e informatiche
Settore concorsuale e Settore scientifico disciplinare / Scientific sector: 01/B1; INF/01 – Informatica

Titolo dell’assegno di ricerca / Topic of the research fellowship “assegno di ricerca”:
Il bando sono consultabili dal sito dell’Ateneo, del MUR e di Euraxess / The calls are available on the University, MUR and Euraxess websites

Testo in italiano:
Apprendimento Automatico, Predizione, Interpretazione e Integrazione di Verifica Runtime e Apprendimento Automatico.

Text in English:
Machine Learning, Prediction, Interpretation, and Integration of Runtime Verification and Machine Learning.

Obiettivi previsti e risultati attesi del programma di ricerca in cui si colloca l’attività dell’assegno di ricerca / Foreseen objectives and results of the research programme performed by the research fellow “assegno di ricerca”:
Il bando sono consultabili dal sito dell’Ateneo, del MUR e di Euraxess / The calls are available on the University, MUR and Euraxess websites

Testo in italiano:
Il programma di ricerca sarà strutturato in due blocchi principali, vale a dire (i) apprendimento automatico, previsione e interpretazione e (ii) integrazione di verifica del runtime e apprendimento automatico.

Apprendimento automatico, previsione e interpretazione
Il machine/deep learning è un ramo dell'intelligenza artificiale (AI) che consente ai computer di apprendere dai dati di addestramento. Gli algoritmi di machine/deep learning sono in grado di rilevare modelli nei dati e apprendere da essi, al fine di effettuare previsioni e interpretazioni avanzate dei dati. Applicazioni significative in tale ambito includono analisi dei dati in tempo reale, controllo di qualità, pianificazione e programmazione della produzione nei processi industriali. Le tecniche di machine learning/deep learning possono consentire alle aziende sia di creare e distribuire modelli di prodotto in modo rapido ed efficace sia di migliorare i propri processi di produzione, riducendo in tal modo il tempo necessario per immettere nuovi prodotti o servizi sul mercato. Tali tecniche permettono, inoltre, di scoprire relazioni nascoste tra i dati e, sulla base di tali relazioni, apprendere in modo autonomo e adattivo. Grazie a questo approccio, gli algoritmi di apprendimento possono essere utilizzati come strumento predittivo (Predictive Analytics) in grado di ampliare l’orizzonte temporale delle informazioni, dal presente al futuro, grazie all’integrazione sistemistica di condizioni e probabilità del verificarsi di un evento. Nel progetto verranno analizzate e studiate la manutenzione predittiva e l’ispezione dei prodotti in tempo reale, nonché la collaborazione tra esseri umani e robot durante il ciclo produttivo.
L’attività sarà organizzata lungo tre direttrici principali:

RESEARCH SERVICES AREA
Research Training Office
Department Head: Sandra Salvador
Procedure Supervisor: Sandra Salvador
Procedure Compiler: Francesca Mion
1. L'analisi dello stato dell'arte sugli approcci più promettenti al machine/deep learning, con particolare enfasi sulle capacità di apprendimento continuo.

2. Lo studio e lo sviluppo di approcci di machine learning/deep learning per analizzare problemi di particolare rilievo in ambito industriale, fra i quali menzioniamo l'analisi dei dati in tempo reale, la previsione e l'interpretazione dei dati nei processi industriali per il conteggio di oggetti, l'identificazione di anomalie, la manutenzione predittiva e il rilevamento di intrusi in reti complesse così come il riconoscimento di azioni, piani e intenzioni nel contesto della collaborazione uomo-robot.

3. La valutazione sperimentale e il testing degli approcci sviluppati da effettuare su casi aziendali proposti dalle aziende manifatturiere che saranno coinvolti nel progetto, con particolare attenzione all'analisi delle correlazioni fra i dati, all'analisi dei modelli, all'identificazione di relazioni significative tra dati, agli algoritmi di classificazione, previsione, clustering e segmentazione.

**Integrazione di verifica runtime e apprendimento automatico**

In molti settori industriali, i sistemi generano flussi continui di dati durante la loro esecuzione, come accade, ad esempio, nel caso delle informazioni di telemetria, che possono essere utilizzate per eseguire attività fondamentali quali il rilevamento di anomalie e il riconoscimento anticipato dei guasti e la manutenzione preventiva. I modelli di machine/deep learning sono stati sfruttati per questi compiti con crescente successo, ma difficilmente forniscono garanzie sulla loro esecuzione, un problema che è esacerbato dalla mancanza di interpretabilità. In molti contesti critici sono pertanto necessari dei metodi formali in grado di garantire il corretto comportamento di un sistema. Tuttavia, specificare in anticipo tutte le proprietà rilevanti e costruire un modello completo del sistema rispetto al quale verificare le proprietà di interesse è spesso fuori portata in molti casi concreti. Per superare queste limitazioni, le tecniche di verifica runtime, che non richiedono una specifica esplicita del modello, rappresentano un'alternativa praticabile e promettente.

L'obiettivo generale è quello di sviluppare e valutare sperimentalmente un framework che integri tecniche leggere di verifica in fase di esecuzione, come il monitoring (ma anche la diagnosi e la riparazione) con metodi di machine/deep learning, al fine di derivare automaticamente proprietà rilevanti relative a comportamenti indesiderati del sistema considerato da utilizzare per rilevare in anticipo possibili anomalie e prevedere guasti futuri. L'attività trarrà notevole vantaggio da un'analisì critica degli approcci al rilevamento delle anomalie, al riconoscimento anticipato dei guasti e alla manutenzione preventiva proposti in letteratura. Verranno indagati sia gli approcci basati su tecniche simboliche sia quelli che fanno uso di modelli e modelli di machine/deep learning. Parallelamente, verrà effettuata una revisione degli strumenti esistenti e della loro applicazione in settori industriali rilevanti. Verrà, inoltre, effettuata un'attenta analisi della natura dei dati generati nei diversi ambiti della manifattura avanzata e la raccolta di idonei dataset. Quest'ultima attività sarà svolta in collaborazione con operatori del settore.

L'attività sarà organizzata in due passi principali:

1. **Primo passo.** Verrà sviluppato un ambiente unificante generale e flessibile che combini tecniche di verifica runtime e machine/deep learning. Tale ambiente verrà utilizzato per costruire monitor robusti in grado di imparare dai fallimenti. Un esperto del settore fornirà al monitor un insieme iniziale di proprietà rilevanti e naturali da monitorare rispetto a un sistema, che codificano comportamenti scorretti noti; successivamente, attraverso un processo iterativo di raffinamento, l'ambiente scoprirà autonomamente nuove proprietà rilevanti, diventando capace, nel tempo, di identificare comportamenti indesiderati in anticipo e con un livello di dettaglio e copertura significativamente più elevato rispetto alle specifiche originali.

La scoperta e l'estrazione delle proprietà saranno effettuate mediante adeguate tecniche di machine/deep learning (alberi decisionali, algoritmi genetici, reti neurali). La struttura modulare
The research program will be structured in two main blocks, namely (i) machine learning, prediction, and interpretation, and (ii) integration of runtime verification and machine learning.

Machine learning, prediction, and interpretation

Machine/deep learning is a branch of artificial intelligence (AI) that enables computers to learn from training data. Machine/deep learning algorithms are able to detect patterns in data and learn from them, in order to make predictions and advanced data interpretation. Example applications include real-time data analytics, quality control, planning and scheduling for production in industrial processes. Machine/deep learning techniques may allow companies to both quickly create and deploy product models and improve their production processes, thereby reducing the time to bring new products or services to the market. These techniques also allow one to discover hidden relationships among data, and, on the basis of these relationships, to learn autonomously and adaptively. Thanks to this approach, learning algorithms can be used as a predictive tool (Predictive Analytics) able to expand the time horizon of information, from the present to the future, thanks to the mathematical combination between condition and probability of the occurrence of an event. Real-time predictive maintenance and inspection of products as well as the collaboration of humans and robots during the production cycle will be analyzed and studied in the project.

The activity will be organized along three major directions:

1. The analysis of the state of the art on the most promising machine/deep learning approaches, with particular emphasis to the continuous learning capabilities.
2. The study and the development of machine/deep learning approaches to analyze important problems in industrial applications including real-time data analytics, data prediction and interpretation in industrial processes for object counting, anomaly identification, predictive maintenance and intruder detection in complex networks as well as action, plan and intention recognition in human-robot collaboration.
3. The experimental evaluation and testing of the developed approaches carried on business cases proposed by manufacturing companies that will be involved in the project, with particular emphasis on analysis of data correlations, patterns analysis, identification of significant relationships among data, classification algorithms, prediction algorithms, clustering and segmentation algorithms.

Integration of runtime verification and machine learning

In many industrial domains, systems generate continuous streams of data during their execution, like, for instance, telemetry information, that can be used to perform fundamental tasks like anomaly detection and preemptive failure recognition and maintenance. Machine/deep learning models have been exploited for these tasks with increasing success, but they hardly provide guarantees over their
execution, a problem which is exacerbated by their lack of interpretability. In many critical contexts, formal methods, which are able of ensuring the correct behaviour of a system, are thus necessary. However, specifying in advance all the relevant properties and building a complete model of the system against which to check them is often out of reach in real-world scenarios. To overcome these limitations, runtime verification techniques, that do not require an explicit specification of the model, are a viable and promising alternative.

The general aim is to develop and experimentally evaluate a framework that pairs lightweight runtime verification techniques, like monitoring (but also diagnosis and repairing) with machine/deep learning methods, in order to automatically derive relevant properties related to bad behaviours of the considered system that can be used to early detect anomalies and to predict future failures. The activity will considerably benefit from a critical analysis of approaches to anomaly detection, early failure recognition, and preemptive maintenance proposed in the literature. Both the approaches based on symbolic techniques and those making use of machine/deep learning methods and models will be investigated. In parallel, a review of existing tools and of their application to relevant industrial domains will be done. A careful analysis of the nature of the data generated in the various fields of advanced manufacturing and the collection of suitable datasets will be carried out as well. This last activity will be done in collaboration with people from industry.

The activity will be organized in two main steps:

1. First step. A general and flexible unifying framework that combines runtime verification techniques and machine/deep learning will be developed. It will be exploited to build robust monitors which are able to learn from failures. A domain expert will provide the monitor with an initial set of relevant and natural properties to be monitored against a system, encoding bad behaviours; then, by means of an iterative refinement process, the framework will autonomously discover new relevant properties, becoming able, over time, to identify undesired behaviours in advance, and with a significantly higher level of detail and coverage than the original specifications.

   Property discovery and extraction will be carried out by means of suitable machine/deep learning techniques (decision trees, genetic algorithms, neural networks). The modular structure of the framework will make it possible to choose the learning component taking into account the nature of the data generated by the monitored systems. This part of the work will be carried out in collaboration with other researchers and people from industry. The possible addition of diagnostic and repairing functionalities to the framework will also be investigated.

2. Second step. The subsequent step will be devoted to the grounding of the developed framework. A preliminary experimental evaluation of the framework will be done against some public datasets. Then, the industries involved in the project will experiment the framework on their own data collected and suitably prepared during the second phase. On the basis of the outcomes of the experimental evaluation, the framework will possibly be revised and refined. In addition, specific additions tailored to the needs of specific application domains will be considered.

Struttura dell'Università di Udine presso la quale verrà sviluppata l’attività di ricerca / Department or other structure of the University of Udine where research activities will be carried out:

L’attività di ricerca sarà sviluppata prevalentemente presso il Dipartimento di Scienze Matematiche, Informatiche e Fisiche (DMIF) dell’Università degli Studi di Udine. / The research activity will be developed predominantly at the Department of Mathematics, Computer Science and Physics of the University of Udine.
Nota / Note: In base alle esigenze del progetto PNRR su cui grava il finanziamento, l’assegnista di ricerca potrà dover svolgere parte delle attività presso altre Università e Istituzioni coinvolte nel medesimo progetto. / Based on the needs of the PNRR project that finances the research grant, the research fellow may have to carry out part of the activities at other universities and institutions involved in the project.

Importo dell’assegno di ricerca (al lordo oneri carico assegnista) / Total grant gross for the research fellowship:

€ 61,612,48

Durata dell’assegno di ricerca / Duration of the research fellowship “assegno di ricerca”:

24 mesi / months

Finanziamento / Financed by:


Requisiti di ammissione / Minimum qualifications necessary:

- Possesso del titolo di Dottore di ricerca o titolo equivalente conseguito all’estero;
- possesso di un curriculum scientifico professionale idoneo allo svolgimento dell’attività di ricerca contemplata.
- Research doctorate or equivalent qualification obtained abroad;
- professional scientific curriculum suitable for the research activity above mentioned.

Procedura selettiva / Competition procedure:

Valutazione per titoli e colloquio / Evaluation of titles and oral exam

I risultati della valutazione dei titoli saranno resi noti agli interessati nel corso del colloquio / The evaluation of the qualifications will be disclosed to candidates during the interview
Calendario del colloquio / Calendar of the oral exam

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<td>Data / Date</td>
<td>15 dicembre / December 2023</td>
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<tr>
<td>Ora / Time</td>
<td>15:00 / 3:00 pm (Italian time)</td>
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<td>Luogo / Place</td>
<td>Studio della professoressa Carla Piazza presso il Dipartimento di Scienze Matematiche, Informatiche e Fisiche (DMIF) - via delle scienze, 206 - Udine / Office of professor Carla Piazza, Department of Mathematics, Computer Science and Physics - via delle scienze, 206 - Udine</td>
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Per sostenere il colloquio i candidati devono esibire un valido documento di riconoscimento. / Candidates must come to the interview with a valid identity document.

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