



Decree of the Rector n. 1122 of 06/11/2023
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. 1122 of 06/11/2023). 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 announcement for the assignment of 1 research grant at the University of Udine, entitled "EXTRA EYE - Egocentric and eXocenTRic views for An object-level human bEhavior anaLYsis and undErstanding through tracking in complex spaces" SSD: ING-INF/05 (principal investigator, Christian Micheloni)

Research grant co-funded by the resources of the project PRIN 2022 - Prot. n. 2022Y7C4JM

Art. 1

A selection procedure is hereby launched for the award of 1 research grant at the University of Udine, as identified in Attachment A which constitutes an integral part of the present announcement.

The research grant is linked to the research project and is subject and conditioned upon the relative funding.

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

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 Bachelor's degree or Master's degree courses, 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 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

¹ Please be aware that the residence permit is not an identification document.



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 10, 2023 at 2:00 pm (Italian time) and ends on January 12, 2024 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.

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/it/pagine-speciali/quida/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: Christian Micheloni
Qualifica / Position: Professore Ordinario / Full Professor
Dipartimento / Department: Scienze Matematiche, Informatiche e Fisiche (DMIF) / Mathematics, Computer Science and Physics
Area MUR / Research field: 09 - Ingegneria industriale e dell'informazione
Settore concorsuale e Settore scientifico disciplinare / Scientific sector: 09/H1; ING-INF/05 - Sistemi di elaborazione delle informazioni

Titolo dell'assegno di ricerca / Topic of the research fellowship "assegno di ricerca":

I bandi 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:

EXTRA EYE - Viste egocentriche e terza persona per l'analisi e la comprensione del comportamento umano a livello di oggetto attraverso il tracking in spazi complessi.

Text in English:

EXTRA EYE - Egocentric and eXocentRiC views for An object-level human bEhavior analYsis and undErstanding through tracking in complex spaces.

Obiettivi previsti e risultati attesi del programma di ricerca in cui si colloca l'attività dell'assegnista di ricerca / Foreseen objectives and results of the research programme performed by the research fellow "assegnista di ricerca":

I bandi 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:

Abstract del progetto	In ambienti di attività sociale, la comprensione e l'analisi delle attività degli utenti è sempre più cruciale. Il comportamento degli utenti fornisce statistiche e informazioni preziose su un determinato spazio e sulle interazioni con gli oggetti. In settori come la vendita al dettaglio, gli sforzi si sono concentrati sul monitoraggio dei movimenti dei clienti e delle interazioni con i prodotti. Tuttavia, questo problema di analisi rimane aperto a causa di varie complessità degli oggetti, tra cui occlusioni e cambiamenti di aspetto. La ricerca sta esplorando attivamente questioni relative all'automazione degli acquisti e ai servizi di analisi. Il progetto EXTRA EYE mira a sviluppare un sistema di computer vision completo che utilizza due prospettive principali: un punto di vista "esocentrico" (in terza persona) da telecamere fisse nell'ambiente e un punto di vista "egocentrico" (in prima persona) da telecamere indossabili del cliente. EXTRA EYE si basa su tre pilastri fondamentali per l'analisi del comportamento umano: un modulo FPV (First-Person View) che mira a comprendere le interazioni tra utente e oggetto dalla visione egocentrica, un modulo TPV (Third-Person View) che elabora i segnali esocentrici, accompagnato da un'unità di aggregazione che integra anche le informazioni provenienti dagli altri componenti per eseguire un'analisi comportamentale specifica del contesto, e un modulo Object Tracking che supporta i primi due
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	<p>componenti tracciando gli oggetti di interesse sia dal punto di vista in terza persona che da quello in prima persona. Il tracciamento degli oggetti in prima persona è notoriamente difficile, anche in scenari di breve durata. Il progetto mira a sviluppare un algoritmo che sfrutti entrambe le prospettive FPV e TPV. Questo approccio prevede l'integrazione di recenti architetture di deep learning per il tracking in TPV (e.g., siamese networks, deep discriminative networks, e transformer) con inductive bias specifici per la FPV, come la posizione delle mani dell'utente. Inoltre, verranno impiegati modelli per stabilire le corrispondenze tra le scene catturate nei flussi video FPV e TPV. Combinando tutti questi elementi, il progetto mira a creare un approccio di tracking olistico, robusto ed efficiente, in grado di seguire in tempo reale vari oggetti di interesse attraverso più telecamere dinamiche e statiche.</p>
<p>Obiettivi del progetto</p>	<p>Questo progetto di ricerca mira a creare algoritmi avanzati di visual object tracking in grado di identificare e localizzare con precisione oggetti arbitrari in video acquisiti da entrambe le viste egocentriche FPV e TPV. L'obiettivo primario è quello di esplorare la possibilità di sviluppare un algoritmo online e in tempo reale in grado di sfruttare efficacemente le informazioni presenti nei video FPV e TPV per affrontare i problemi che riguardano le due viste indipendenti. Queste sfide includono le occlusioni degli oggetti causate dalle interazioni tra la persona e gli oggetti, i rapidi movimenti della telecamera, la sfocatura dovuta al movimento della testa e le variazioni inter e intra-class nell'aspetto degli oggetti.</p> <p>Nel complesso, i contributi attesi da questo progetto comprendono:</p> <ul style="list-style-type: none"> ▪ progettazione e sviluppo di un algoritmo online, indipendente dalla categoria e in tempo reale, per il tracciamento di oggetti multipli in video FPV egocentrici e TPV standard sincronizzati; ▪ studiare la relazione tra la soluzione sviluppata e i moduli algoritmici di alto livello per compiti a valle, come il riconoscimento di azioni; ▪ validazione delle prestazioni dell'algoritmo rispetto allo stato dell'arte utilizzando dataset pubblicamente disponibili di video FPV egocentrici e TPV, tra cui EGO4D, EPIC-KITCHENS, LaSOT, GOT-10k, VOTS2023; ▪ pubblicare i risultati in conferenze e riviste di computer vision e machine learning di prestigio; ▪ partecipazione a competizioni di ricerca incentrati sui temi del progetto, presentando gli algoritmi sviluppati.
<p>Descrizione del progetto</p>	<p>L'attività di ricerca rientra nel progetto "EXTRA EYE: Egocentric and eXocenTRic views for An object-level human bEhavior analYsis and undErstanding through tracking in complex spaces" finanziato dal programma PRIN 2022 del Ministero dell'Università e della Ricerca. Le attività sono svolte in collaborazione con l'Università di Macerata e l'Università di Catania.</p> <p>L'attività di ricerca si concentrerà sul visual object tracking di oggetti precedentemente rilevati attraverso più videocamere impostate in modalità FPV o TPV. L'algoritmo dovrà fornire un elenco continuo di localizzazioni di oggetti che ne descrivano la posizione e lo stato di interazione con l'ambiente. L'impostazione avrà una stretta relazione con il Multiple Object Tracking (MOT), in quanto l'algoritmo di tracking</p>



	<p>dovrà tenere traccia di diverse istanze di oggetti, potenzialmente della stessa categoria, allo stesso tempo. Pertanto, la ricerca esplorerà i metodi che consentono agli algoritmi MOT di funzionare nello scenario FPV-TPV, in cui il riferimento agli oggetti multipli deve essere mantenuto anche in presenza di frequenti occlusioni nelle viste corrispondenti (ad esempio, dovute alle mani dell'osservatore della telecamera che coprono gli oggetti o ad altri soggetti che passano). L'algoritmo di tracciamento potrebbe utilizzare inductive bias per l'FPV, come la posizione delle mani dell'utente (Dunnhofer et al., 2023), nonché strategie di corrispondenza delle immagini tra i video TPV e FPV. Il ricercatore dovrà esplorare le più recenti architetture di deep learning, visto il loro ampio successo in una moltitudine di domini. In particolare, si prevede di fondere le metodologie di tracking di singoli oggetti di maggior successo con i più recenti paradigmi MOT. In passato, la MOT è stata affrontata principalmente con l'approccio del tracking-by-detection, ma un lavoro molto recente (Yan et al., 2022) ha rivelato come la combinazione di tracker di oggetti singoli all'interno della logica MOT possa portare benefici per tenere traccia simultaneamente di più oggetti.</p> <p>Per implementare l'attività, il ricercatore sfrutterà i dati e le risorse disponibili nel laboratorio di Machine Learning and Perception. Inoltre, potrà attingere alle risorse dell'Università di Macerata e dell'Università di Catania. Su richiesta del ricercatore, potranno essere organizzati periodi di ricerca presso tali istituti.</p>
<p>Possibili applicative potenzialità</p>	<p>Il progetto è in linea con la Strategia Nazionale Italiana di Specializzazione Intelligente (NSSS/SNSI) incentrata su "Industria intelligente e sostenibile, energia, ambiente" e "Salute, nutrizione, qualità della vita". L'obiettivo è sviluppare un prototipo per l'analisi avanzata dell'interazione uomo-oggetto nei negozi al dettaglio, migliorando la gestione del negozio e i servizi al cliente, come le raccomandazioni e la fatturazione automatica. Il raggiungimento di questi obiettivi implica una ricerca di base che utilizza una combinazione di telecamere in terza e prima persona, insieme ad algoritmi innovativi di huma-object interaction understanding e tracking. Nel settore della vendita al dettaglio, il progetto EXTRA-EYE studierà il comportamento, le esigenze e la soddisfazione dei consumatori utilizzando l'analisi dei dati. Aiuterà i rivenditori a ottimizzare le operazioni per un'esperienza di acquisto personalizzata e un processo decisionale efficace. I dati dei sensori tracciano l'attrazione degli acquirenti, l'attenzione agli espositori e le interazioni con i prodotti. La tecnologia all'avanguardia che verrà studiata consentirà un'analisi non invasiva del comportamento dei consumatori, permettendo ai rivenditori di offrire esperienze personalizzate senza interrompere il normale comportamento di acquisto. Questo approccio farà progredire la ricerca sul marketing al dettaglio e la scienza comportamentale, fornendo risposte efficienti a domande commerciali complesse. Le tecnologie esplorate possono estendersi al di là dei negozi al dettaglio e trovare applicazione in vari ambiti in cui il tracciamento delle interazioni utente-oggetto è essenziale per l'analisi e l'assistenza del comportamento. Ad esempio, ambienti industriali come la produzione, l'assemblaggio di prodotti e la robotica possono trarre vantaggio da telecamere fisse e indossabili per garantire la sicurezza dei lavoratori, ottimizzare le</p>





	<p>caratteristiche del luogo di lavoro, gestire l'uso delle attrezzature e offrire suggerimenti. Negli ambienti domestici, questi algoritmi assisteranno gli utenti, compresi gli anziani e i disabili, monitorando il comportamento, migliorando la qualità della vita e garantendo la sicurezza. L'uso di telecamere indossabili e di sistemi di feedback integrati aiuterà gli utenti a interagire con l'ambiente circostante, offrendo assistenza, guida al funzionamento degli apparecchi e promemoria. Questo progetto mira a far progredire le conoscenze fondamentali nell'analisi dell'interazione uomo-oggetto. A differenza degli sforzi precedenti incentrati su singole prospettive, il nostro progetto combinerà in modo unico i segnali egocentrici ed esocentrici per una comprensione olistica. Il progetto sarà pioniere nel visual tracking degli oggetti in contesti dinamici in cui gli esseri umani interagiscono con vari oggetti. Questa ricerca stabilirà algoritmi fondamentali, scenari applicativi e dati per l'innovazione futura. Ogni unità di ricerca contribuisce individualmente a questo progresso. UNICT si concentrerà sulle interazioni atomiche uomo-oggetto, che servono come elementi di base per le applicazioni di visione egocentrica. UNIUD introdurrà nuovi algoritmi di referenziazione e localizzazione degli oggetti, migliorando il tracking di oggetti multi-vista. UNIMC è all'avanguardia nel riconoscimento delle attività da entrambe le prospettive, con un'enfasi sull'integrazione dei segnali per una più ampia comprensione del comportamento in tutti i domini.</p>
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Text in English:

<p>Abstract</p>	<p>In socially acceptable environments, understanding and analyzing user activities is increasingly crucial. User behavior yields valuable statistics and insights about a given space and interactions with objects. In sectors like retail, extensive efforts have focused on tracking customer movements and product interactions. However, this challenge remains open due to various complexities, including occlusions, appearance changes, and dynamic backgrounds. Researchers are actively exploring issues related to automating purchases and analytics services. The EXTRA EYE project aims to develop a comprehensive computer vision system that uses two main perspectives: an "exocentric" (third-person) viewpoint from fixed cameras in the environment and an "egocentric" (first-person) viewpoint from wearable customer cameras. EXTRA EYE rests on three key pillars for Human Behavior Analysis: a First-Person View (FPV) module which aims to understand take/release user-object interactions from egocentric vision, a Third-Person View (TPV) module which processes exocentric signals, accompanied with an aggregation unit that also integrates information from the other components to perform context-specific behavioral analysis, and an Object Tracking module which supports the former two components by tracking objects of interest from both the third- and first-person points of view. Tracking objects in first-person view is notoriously challenging, even in short-term scenarios. The project aims to develop an algorithm that leverages both FPV and TPV perspectives. This approach involves integrating recent deep learning architectures for TPV tracking (e.g., siamese networks, deep discriminative networks, and transformer architectures) with FPV-specific cues,</p>
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	<p>such as the position of the user's hands. Additionally, models will be employed to establish correspondences between scenes captured in the FPV and TPV streams. By combining all these elements, the project aims to create a holistic, robust, and efficient tracking approach capable of real-time tracking of various objects of interest across multiple dynamic and static cameras.</p>
<p>Objectives of the project</p>	<p>This research project aims to create advanced visual object tracking algorithms that can accurately identify and localize arbitrary objects in videos acquired from both the egocentric FPV and TPV views. The primary objective is to explore the possibility of developing an online, real-time algorithm that can exploit effectively the information present in FPV and TPV videos to address the issues affecting the two independent views. These challenges include object occlusions caused by interactions between the person and objects, rapid camera movements, motion blur due to head motion, and variations in object appearance both within and across classes.</p> <p>Overall, the expected contributions of this project include:</p> <ul style="list-style-type: none"> ▪ designing and developing an online, class-agnostic, and real-time algorithm for tracking multiple objects in synchronized egocentric FPV and standard TPV videos; ▪ investigating the relationship between the developed solution and high-level algorithmic modules for downstream tasks, such as action recognition; ▪ validating the algorithm's performance against the state-of-the-art using publicly available datasets of egocentric FPV videos and TPV videos, including EGO4D, EPIC-KITCHENS, LaSOT, GOT-10k, VOTS2023; ▪ publishing the findings in renovated computer vision and machine learning conferences and journals; ▪ participating in research competitions focused on the project's topics by submitting the developed algorithms.
<p>Project description</p>	<p>The research activity falls within the project "EXTRA EYE: Egocentric and eXocenTRic views for An object-level human bEhavior analYsis and undErstanding through tracking in complex spaces" funded by the Italian Ministry of University and Research's program PRIN 2022. The activities are carried on in collaboration with the University of Macerata (Macerata, Italy) and the University of Catania (Catania, Italy).</p> <p>The research activity will focus on tracking previously detected objects across multiple video cameras set in FPV or TPV modality. The algorithm should provide a continuous list of object localizations that describe the position of the objects as well as their state of interaction with the environment. The setting will have a close relationship to Multiple Object Tracking (MOT) as the tracking algorithm will need to keep track of different object instances, potentially of the same category, at the same time. Hence, the research will explore methods enabling MOT algorithms to work in the custom FPV-TPV scenario, where reference to the multiple objects must be maintained across the occurrence of frequent occlusions in the corresponding views (e.g. given by the camera viewer's hands covering the objects or other subjects passing by). The tracking algorithm is expected to employ FPV specific cues, such as the</p>





	<p>position of the user's hands (Dunnhofer et al., 2022), as well as image matching strategies to find correspondences between the TPV and FPV videos. The researcher is expected to explore the most recent deep learning architectures due to their extensive success across a multitude of domains. More specifically, merging the most successful single object tracking methodologies, such as siamese networks, deep discriminative networks, and transformer architectures, with the most recent MOT paradigms is expected. In the past, MOT has been tackled mostly by the tracking-by-detection approach, but very recent work (Yan et al., 2022) revealed how combining single object trackers inside the MOT logic can bring benefits for simultaneously keeping track of multiple objects.</p> <p>To implement the activity, the researcher will leverage publicly available data and resources from the Machine Learning and Perception's lab. Additionally, he/she may tap into the resources of the University of Macerata and the University of Catania. Secondment periods at such institutes can be arranged on the researcher's desire.</p>
Possible application potentialities	<p>The project aligns with the Italian National Smart Specialization Strategy (NSSS/SNSI) focusing on "Smart and sustainable industry, energy, environment," and "health, nutrition, quality of life." It aims to develop a prototype for advanced human-object interaction analysis in retail stores, enhancing store management and customer services, such as recommendations and automatic billing. Achieving these goals involves fundamental research using a combination of third- and first-person cameras, along with innovative interaction and tracking algorithms. In retail settings, the EXTRA-EYE project will investigate consumer behavior, needs, and satisfaction using data analysis. It aids retailers in optimizing operations for a personalized shopping experience and effective decision-making. Sensor data will track shopper attraction, attention to displays, and interactions with products. Cutting-edge technology will enable non-invasive analysis of consumer behavior, allowing retailers to offer personalized experiences without disrupting normal shopping behavior. This approach will advance retail marketing research and behavioral science, providing efficient answers to complex business questions. The explored technologies can extend beyond retail stores and find applications in various domains where tracking user-object interactions is essential for behavior analysis and assistance. For instance, industrial settings like manufacturing, product assembly, and robotics can benefit from fixed and wearable cameras to ensure worker safety, optimize workplace features, manage equipment usage, and offer guidance. In home environments, these algorithms will assist users, including seniors and those with disabilities, by tracking behavior, enhancing quality of life, and ensuring safety. The use of wearable cameras and integrated feedback systems helps users interact with their surroundings, offering assistance, appliance operation guidance, and reminders. This project aims to advance fundamental knowledge in human-object interaction analysis. Unlike previous efforts focused on single perspectives, our project uniquely combines egocentric and exocentric signals for a holistic understanding. We're pioneering object tracking in dynamic contexts where humans interact with various objects. This research will establish baseline algorithms, application scenarios, and data for</p>





	future innovation. Each research unit contributes to this advancement individually. UNICT focuses on atomic human-object interactions, serving as building blocks for egocentric vision applications. UNIUD introduces novel object referencing and localization algorithms, enhancing multi-view object tracking. UNIMC pioneers activity recognition from both perspectives, with an emphasis on signal integration for broader behavioral understanding across domains.
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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:

Dipartimento di Scienze Matematiche, Informatiche e Fisiche (DMIF) / Department of Mathematics, Computer Science and Physics

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

€ 29.100,00

Durata dell'assegno di ricerca / Duration of the research fellowship "assegno di ricerca":

18 mesi / months

Finanziamento / Financed by:

La copertura finanziaria graverà sul progetto/fondi:

- progetto PRIN 2022 – “Egocentric and eXocenTRic views for An object-level human bEhavior analYsis and undErstanding through tracking in complex spaces (EXTRA EYE)”; Prot. n. 2022Y7C4JM. Decreto di finanziamento n. 959 del 30/06/2023 - Settore PE6. Codice CUP G53D23002920006. Ministero dell'Università e della Ricerca (Finanziato dall'Unione Europea, NextGenerationEU);
- RIC_LIB_MICHELONI.

Requisiti di ammissione / Minimum qualifications necessary:

- Possesso di un diploma di laurea vecchio ordinamento (ante decreto 3 novembre 1999 n. 509) o di laurea specialistica/magistrale (ex decreto 3 novembre 1999 n. 509 e decreto 22 ottobre 2004 n. 270) o titolo equivalente conseguito all'estero;
- possesso di un curriculum scientifico professionale idoneo allo svolgimento dell'attività di ricerca contemplata.
- University degree obtained before Decree n. 509 of 3 November 1999 or specialistic/Master's degree (post decree n. 509 of 3 November 1999 and decree n. 270 of 22 October 2004) or equivalent degree 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	Modalità / Modality	Videoconferenza / Videoconference
	Data / Date	22 gennaio / January 2024
	Ora / Time	9:00 / 9:00 am (Italian time)
	Luogo / Place	-

Per sostenere il colloquio i candidati devono esibire un valido documento di riconoscimento. /
Candidates must come to the interview with a valid identity document.

Eventuali variazioni saranno rese note esclusivamente mediante pubblicazione all'albo ufficiale on line dell'Ateneo / Any change will be made public solely through publication on the University web site
http://web.uniud.it/ateneo/normativa/albo_ufficiale

Nota / Note: Le indicazioni sulle modalità di svolgimento della prova in modalità telematica saranno inviate ai candidati con successiva email da parte del Presidente della Commissione. Ai fini dell'identificazione e a pena di esclusione dalla procedura selettiva, ciascun candidato è tenuto ad identificarsi prima che il colloquio abbia inizio, esibendo il medesimo documento di identità allegato alla domanda di ammissione al concorso. Il candidato deve risultare reperibile nella giornata e all'orario indicato sul bando. Il mancato collegamento, l'irreperibilità del candidato nel giorno o nell'orario stabilito o la mancata esibizione del documento identificativo, sono motivo di esclusione dalla procedura selettiva. La registrazione delle prove orali è vietata. L'Ateneo adotterà pertanto tutti i provvedimenti in suo potere per tutelare i soggetti coinvolti qualora venissero diffuse tramite internet – o altri mezzi di diffusione pubblica – video, audio o immagini della procedura selettiva. / Instructions on how the video interviewing will be conducted will be provided to candidates by the Chairman of the Examining Board via email. For identification purposes, each candidate is required to identify him/herself before the interview by exhibiting the same identification document attached to the application. Candidates must be available on the day and time established by the call for applications. Failure of the candidate to establish a video connection, the unavailability of the candidate on the day and/or time established or failure of the candidate to provide the required identification document are all grounds for exclusion from the selection procedure. Recording of the video interviews is prohibited. The University will adopt all the measures within its power to protect all personnel involved as a result of dissemination via the internet or via other forms of public dissemination, of videos, audios or other pictures of the selection procedures.

Commissione giudicatrice / Examining Board:

Nome e Cognome	Qualifica	SSD	Università
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Christian Micheloni	PO	ING-INF/05	Università degli Studi di Udine
Niki Martinel	PA	INF/01	Università degli Studi di Udine
Matteo Dunnhofer	RTD	ING-INF/05	Università degli Studi di Udine
Membri Supplenti / Temporary members			
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