

# DECRETO RETTORALE

## Decree of the Rector n. 626 of 04/07/2024

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. 626 of 04/07/2024). 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

Call for applications for the award of 1 grant for the performance of research activities at the University of Udine on the topic "EXTRA EYE - Egocentric and eXocentRiC views for An object-level human bEhavior analYsis and undErstanding through tracking in complex spaces" SSD: IINF-05/A (principal investigator, Christian Micheloni)

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

### Art. 1

A selection proceeding is hereby announced for the award of 1 research grant at the University of Udine for the performance of the research activity identified in Annex A, which forms an integral and substantial part of this call. The research grant is linked to the research project on which it is based and is subject to the corresponding financial coverage.

The grant may be renewed with the winner in accordance with the provisions of Article 22 of Law no. 240 of 30 December 2010 (in the text prior to Leg. Decree no. 36 of 30 April 2022, converted with amendments by Law no. 79 of 29 June 2022) and the Regulations of the University of Udine for the awarding of research grants issued by Rector's Decree no. 182 of 31 March 2021, in the presence of a positive assessment by the scientific supervisor of the activity carried out by the research fellow, adequate scientific justification and related financial coverage, within the limits set out in Article 3, letters b) and c) below.

The research grant does not entitle the successful candidate to any rights as regards access to University roles.

Any personal communication to candidates relating to this selection will be sent exclusively to the email address indicated in the application form.

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### Art. 2

The activities covered by the research grant referred to in this call for competition and the admission requirements are indicated and described in Annex A. Failure to meet the admission requirements at the time of applying shall result in the **exclusion** of the candidate from the selection process.

Possession of a PhD qualification or equivalent qualification obtained abroad or, for the sectors concerned only, of a medical specialisation qualification accompanied by an adequate scientific production, constitutes a preferential requirement for the awarding of the grant envisaged for this selection, if it has not been mentioned as an admission requirement.

The Selection Board shall assess, for the sole purpose of admission to the competition, the suitability of any qualification obtained abroad, without prejudice to the assessment of the medical specialisation qualification to which Article 38, paragraph 3.1 of Legislative Decree 165/2001, as amended, and the relevant Community regulations apply.

The Board assesses the qualification obtained abroad based on the relevant documentation enclosed with the application to take part in the selection and may exclude the candidate if the submitted documentation does not provide sufficient elements for the assessment.

Candidates are therefore invited to enclose all documentation in their possession relating to their qualifications in order to provide the Board with sufficient elements to assess their position.

Candidates are admitted to the selection process subject to a reservation and their exclusion, for failure to meet the requirements, may be ordered at any time by reasoned decision.

### Art. 3

The research grant referred to in this call cannot be awarded to the following subjects:

- a) Employees of Universities and the entities referred to in Article 22(1) of Law no. 240 of 30 December 2010 (in the text prior to Leg. Decree no. 36 of 30 April 2022, converted with amendments by Law no. 79 of 29 June 2022).
- b) Recipients of previous research grants pursuant to Law no. 240 of 30 December 2010, for the maximum period allowed by the regulations, excluding the period in which the grant was received in conjunction with a PhD, up to the legal duration of the relevant course.
- c) Those who have already been awarded research grants and fixed-term researcher contracts pursuant to Law no. 240 of 30 December 2010 for a total of 12 years, even if not consecutive.
- d) Those who have a degree of kinship or relationship, 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 principal investigator or a professor/researcher belonging to the department or structure of interest where the research grant activity takes place.

The research grant referred to in this call cannot be cumulated with the following:

- a) Awarded scholarships of any kind, except those granted by national or foreign institutions useful for supplementing, by means of stays abroad, the fellow's training or research activities.
- b) Other research grants.

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- c) Employment relationships, even if part-time, without prejudice to the provisions of the regulations for employees of public administrations.

The grant referred to in this call is also incompatible with simultaneous attendance of degree courses, master's degrees, and PhDs with scholarships and medical specialisation, in Italy and abroad.

Persons who have been convicted of a criminal offence resulting in disqualification from holding public office or inability to contract with the public administration as a secondary penalty are not eligible for selection.

### Art. 4

Applicants must submit, in the manner described in Article 5 below, the application to take part in the selection, duly signed in handwritten or digital form. An application without a signature will result in the **exclusion** of the candidate, except in the case of access through the use of the Public Digital Identity System (SPID) in which case the signature will not be necessary.

The application must be uploaded in its entirety (i.e., every page), **otherwise** the applicant will be **excluded** from the selection.

Applicants must enclose the following with their application for participation in the selection, **under penalty of exclusion**:

1. The professional scientific *curriculum vitae* in Italian or English or one of the additional languages, if any, indicated in Annex A, highlighting the candidate's aptitude for carrying out and implementing the research programme.
2. Copy of valid identity document or other identification document. Citizens of non-EU countries must enclose a copy of their passport.
3. Limited to citizens of non-EU states residing or authorised to reside in Italy, a copy of their residence permit or authorisation to reside in Italy.
4. For candidates who cannot provide a self-certification under the conditions set out below, documentation proving possession of the academic qualification required for admission to the selection. Possession of a higher academic qualification does not exempt the candidate from producing such documentation, which, if missing, will result in exclusion:
  - **Candidates who are Italian citizens or citizens of a European Union Member State** must submit a declaration in lieu of certification and, if necessary, a notarial deed regarding the academic qualification needed for admission (indicating the academic qualification, the academic institution awarding the qualification, the year it was awarded and the mark obtained) and the publications and other qualifications held, indicating for each one all the identification details necessary for the Board's assessment. **The application for participation counts as a declaration in lieu of certification of the declared academic qualification.** If the subject matter of the declaration is not clearly identified in terms of its nature, duration, time setting and institution concerned, the selection board will disregard it. The Administration reserves the right to carry out appropriate checks on the truthfulness of the content of the declarations made; in the event of a false declaration, the provisions of Article 76 of Presidential Decree no. 445/2000 and Articles 483, 485, and 486 of the Italian Criminal Code shall apply. The University will not take into account any certificates attached by candidates who are Italian citizens or citizens of a state belonging to the European Union.

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- **Citizens of a non-European Union State** must submit documents and qualifications in Italian or English or one of the additional languages, if any, indicated in Annex A, under penalty of exclusion from the selection or, as the case may be, non-assessment.  
Documents and titles, originally in a different language, must be accompanied by a translation, made by the candidate under his or her responsibility, into Italian or English or any other language indicated in Appendix A. With reference to the dissertation only, the translation may be limited to an extended abstract.
- **Citizens of a non-EU State regularly residing in Italy** may use declarations in lieu of certification only in respect of states, personal qualities or facts that can be certified or attested to by Italian public bodies, without prejudice to the special provisions contained in the laws and regulations governing immigration and the status of foreigners.
- **Citizens of non-EU states authorised to reside in Italy** may use the aforementioned declarations in cases where they are produced pursuant to international conventions between Italy and the declarant's country of origin.

Applicants may also enclose with their application for assessment purposes their publications and any other qualification deemed useful to prove their qualification in relation to the research programme described in Annex A and to certify any research activity carried out in public and/or private entities (with the indication of the starting date and duration). The submission modalities are similar to those indicated in point 4 of the previous paragraph.

Only the qualifications possessed by the candidate on the date of submission of the application for selection and presented in accordance with Article 5 will be assessed.

Any exclusion from the selection procedure due to lack of eligibility requirements, absence of mandatory documents, failure to sign the application to take part in the selection or submission of the application in a manner other than that provided for in this call will be communicated to the parties concerned exclusively by email to the email address indicated in the application to take part in the selection.

### Art. 5

Registration for this selection will begin on July 11, 2024 at 2:00 pm (Italian time) and will end on July 24, 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 <https://pica.cineca.it/>.

For those who do not already have a user account, the procedure involves a registration phase for the applicant, and a subsequent phase for completing the application online.

Once completed, the application must be signed in the manner (handwritten signature, with attached identity document, or digital signature) described in the online procedure, under penalty of exclusion from the selection. The application does not have to be signed if the above-mentioned online procedure is accessed using the Sistema Pubblico di Identità Digitale (SPID - Digital ID Public System). In the case of a handwritten signature, the applicant must upload the application to the system in its entirety. The information entered in the application form shall constitute a declaration in lieu of certification and affidavit, pursuant to Articles 46 and 47 of Presidential Decree no. 445/2000.

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

It is not permitted to submit attachments to the application in the form of links to files residing on "online storage/file sharing" services or web pages. Reference may not be made to documents or publications submitted to this or other administrations or documents attached to the application for participation in another selection procedure.

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

The University Administration:

- accepts no liability if it is impossible to read the submitted documentation in electronic format due to damaged files;
- does not accept or take into consideration qualifications or documents received in paper form or by any other means than those specified in this article.

The Administration accepts no liability in the event of incorrect indication by the candidate of his/her email address or in the event of failure or delay in communicating a change in the email address indicated in the application, nor for any digital transmission errors attributable to third parties, unforeseeable circumstances or force majeure.

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

### Art. 6

The selection test takes place according to the modalities set out in Annex A.

The test will aim to ascertain the candidates' preparation, experience and research aptitude. It will consist of an assessment of the professional scientific curriculum, publications and titles submitted, and an interview, where applicable.

Failure of the candidate to attend the interview will be considered as withdrawal from the selection, whatever the cause.

Candidates who intend to avail themselves of the benefits provided for by Article 20 of Law no. 104 of 1992 (need for assistance, possible use of additional time for the performance of examination tests) in relation to their disability situation, must declare this and accompany the application with appropriate medical certification in order to allow the Administration to prepare in time the means and tools to guarantee the statutory benefits; failure to submit the medical certification exempts the Administration from any obligation in this regard.

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### Art. 7

The Competition Selection Board is identified in Annex A to this call, of which it forms an integral part. At its first meeting, the Board appoints the Chairperson and the Secretary taking the minutes, and establishes the criteria and procedures for assessing the qualifications and the interview, where applicable.

The results of the assessment must be made known to the parties concerned at the interview, where provided for.

The Board can attribute to the selection a total number of 100 points (one hundred hundredths). At the end of its work, the Board formulates the overall merit list based on the total marks obtained by each candidate and draws up the minutes of the competition operations.

The grant may be awarded, subject to the ranking list, to candidates who have obtained a minimum overall mark of 70/100 (seventy hundredths).

The Board's judgement is final on the merits.

The ranking list will be made public exclusively by publication on the University's official notice board; the outcome of the assessment will not be the subject of personal communication to candidates.

Those who do not declare their acceptance of the research grant and do not present themselves at the structure where the research activities are to be carried out to sign the contract by the deadline communicated by the same to the email address indicated by the candidate in the application shall forfeit their right to the research grant, except for health reasons or reasons of force majeure duly documented and promptly notified.

Candidates holding qualifications obtained abroad, if successful, must submit the following, if not already attached to the application:

- **For degrees issued by a country that is a party to the Lisbon Convention (<https://www.enic-naric.net/>), the following documentation:**
  - *Supplement* Diploma or similar certificate in English issued by the competent University.
  - "Certificate of Verification of Foreign Qualification - CIMEA" issued by CIMEA (Centre for Information on Academic Mobility and Equivalences) via the "*diplome*" service at <https://cimea.diplome.eu/udine/#/auth/login>
- **For degrees issued by a country not party to the Lisbon Convention (<https://www.enic-naric.net/>), one of the following options:**
  - Declaration of the on-site value of the qualification held and the certificate relating to the qualification with examinations and grades. The certificate in a language other than Italian or English must be accompanied by an official translation into one of those languages (certified by the competent diplomatic-consular authority or sworn at a court in Italy).
  - "Certificate of Comparability and Verification of Foreign Qualifications - CIMEA" issued by CIMEA (Centre for Information on Academic Mobility and Equivalences) via the "*diplome*" service at <https://cimea.diplome.eu/udine/#/auth/login>

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If the aforementioned documentation is not available at the time of the conclusion of the contract, the candidate must prove that he or she has requested it and submit it as soon as possible; if it is not submitted within six months of the start of the contract, the candidate will forfeit the contract and will be required to repay any related sums received to date.

### Art. 8

The research activity cannot be started before the contract defining the terms of the collaboration is signed.

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

- a) Be carried out in the context of the research programme covered by the grant and not be a purely technical support to the same.
- b) Close connection with the implementation of the research programme that is the subject of the relationship with the winner.
- c) Having a continuous and in any case temporally defined character, not merely occasional, and in coordination with the overall activity of the University.
- d) Performance in a condition of autonomy, within the sole limits of the programme prepared by the Head of the same, without predetermined working hours.

The research fellow is obliged to submit a detailed written report on the work carried out and the results achieved, together with the opinion of the scientific supervisor, to the reference structure within the deadlines laid down in the contract. The research fellow will also have to submit interim reports and time sheets if requested by the reference structure and/or the scientific supervisor.

The research fellow is bound to strict confidentiality regarding the data and information to which he/she becomes privy in the course of his/her research activity. At the request of the scientific coordinator, he/she will be required to sign an appropriate confidentiality agreement.

The industrial property rights to the results obtained by the research fellow in the performance of the research activity belong exclusively to the University, without prejudice to the moral right of the research fellow to be recognised as an author or inventor.

The University reserves the right to revoke this call for competition for reasons of public interest, should the research project and/or the financial backing on which the research grant is based cease to exist. Should these causes arise after the contract has been signed, the University may terminate the contract without notice.

### Art. 9

The following apply to the grant under this call:

- On tax matters, the provisions of Article 4 of Law no. 476 of 13 August 1984, as amended.
- On social security matters, the provisions of Article 2(26) et seq. of Law no. 335 of 8 August 1995, as amended.
- On compulsory maternity leave, the provisions of the Ministerial Decree of 12 July 2007.
- On sick leave, the provisions of Article 1(788) of Law No 296 of 27 December 2006, as amended.

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During the period of compulsory maternity leave, the allowance paid by INPS pursuant to Article 5 of the 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 in arrears.

### Art. 10

The data collected as part of the procedure referred to in Article 5 is necessary for the proper management of the selection procedure, for the possible subsequent management of the research grant and purposes related to the management of the services provided by the University. The University of Udine is the Data Controller. At any time, the data subject may request access, rectification and, compatibly with the institutional purposes of the University, cancellation and restriction of processing or may object to the processing of his/her data. He/she can always lodge a complaint with the Italian Data Protection Authority. The full information is available on the University of Udine website in the "Privacy" section accessible from the home page [www.uniud.it](http://www.uniud.it) Direct Link: <https://www.uniud.it/it/it/pagine-speciali/guida/privacy>

### Art. 11

For any matters not expressly mentioned in this call, reference is made to the relevant regulations in force cited in the introduction and to the "Internal regulations for the award of research grants pursuant to 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 official in charge of the proceeding is Dr. Sandra Salvador, Head of the Research Services Area of the University of Udine.

The reference office at the University of Udine is the "Area Servizi per la Ricerca - Ufficio Formazione per la Ricerca", Via Mantica 31 - 33100 Udine.

To request information on the call, 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](https://helpdesk.uniud.it/SubmitSR.jsp?type=req&accountId=universityofudine&populateSR_id=42105)



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### Annex 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/IINF-05; IINF-05/A - 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:

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| 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 |
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|                                 | <p>un'analisi comportamentale specifica del contesto, e un modulo Object Tracking che supporta i primi due 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"> <li>▪ 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;</li> <li>▪ studiare la relazione tra la soluzione sviluppata e i moduli algoritmici di alto livello per compiti a valle, come il riconoscimento di azioni;</li> <li>▪ 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;</li> <li>▪ pubblicare i risultati in conferenze e riviste di computer vision e machine learning di prestigio;</li> <li>▪ partecipazione a competizioni di ricerca incentrati sui temi del progetto, presentando gli algoritmi sviluppati.</li> </ul> |
| <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 dovrà tenere traccia di diverse istanze di oggetti, potenzialmente della stessa categoria, allo stesso tempo. Pertanto, la</p>   |

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|  | <p>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</p> <p>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 human-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 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</p> |

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|  | <p>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 pioniero 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:

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| <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, 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> |
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## DECRETO RETTORALE

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| <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"> <li>▪ designing and developing an online, class-agnostic, and real-time algorithm for tracking multiple objects in synchronized egocentric FPV and standard TPV videos;</li> <li>▪ investigating the relationship between the developed solution and high-level algorithmic modules for downstream tasks, such as action recognition;</li> <li>▪ 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;</li> <li>▪ publishing the findings in renovated computer vision and machine learning conferences and journals;</li> <li>▪ participating in research competitions focused on the project's topics by submitting the developed algorithms.</li> </ul>   |
| <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 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.,</p> |

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|                                     | <p>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.</p> <p>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 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.</p> |

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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:**

€ 24.320,00

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

12 mesi / months

**Finanziamento / Financed by:**

La copertura finanziaria graverà sul 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 - M4C2 Inv. 1.1).

**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. / Possession of a 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.

**Modalità di presentazione della documentazione oggetto di valutazione / Arrangements for the submission of documents:**

La modalità di presentazione della documentazione oggetto di valutazione è specificata all'art. 4 del bando. / The way of presenting the documentation under evaluation is specified in art. 4 of the present notice.

Ai fini valutativi, i candidati potranno presentare le pubblicazioni e ogni altro titolo ritenuto utile a comprovare la propria qualificazione in relazione al programma di ricerca descritto nell'Allegato A, nelle seguenti lingue: / For evaluation purposes, candidates may present publications and any other qualifications deemed useful to demonstrate their qualification in relation to the research program described in Attachment A, in the following languages:

- Italiano / Italian
- Inglese / English

## DECRETO RETTORALE

### 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 /<br>Calendar of the oral exam | Modalità / Modality | Videokonferenza / Videoconference |
|   | Data / Date         | 30 luglio / July 2024             |
|   | Ora / Time          | 9:30 / 9:30 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](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.



## DECRETO RETTORALE

### Commissione giudicatrice / Examining Board:

| Nome e Cognome                              | Qualifica | SSD       | Università                      |
|---|-----------|-----------|---------------------------------|
| <b>Membri Effettivi / Permanent members</b> |           |           |                                 |
| Christian Micheloni                         | PO        | IINF-05/A | Università degli Studi di Udine |
| Niki Martinel                               | PA        | INFO-01/A | Università degli Studi di Udine |
| Matteo Dunnhofer                            | RTD       | IINF-05/A | Università degli Studi di Udine |
| <b>Membri Supplenti / Temporary members</b> |           |           |                                 |
| Claudio Piciarelli                          | PA        | INFO-01/A | Università degli Studi di Udine |
| Carlo Drioli                                | PA        | IINF-05/A | Università degli Studi di Udine |