

PARTNER SEARCH FORM

Your contact details

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| Organisation | Bar-Ilan University (BIU) |
| Contact person | Leonid Yavits |
| Department (if needed) | Faculty of Engineering, EnICS Labs (Emerging Nanoscaled Circuits and Systems) |
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Your organisation

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| Describe your Organisation | <p>Bar-Ilan University (BIU) is one of Israel's leading research universities with a strong track record in interdisciplinary research. The EnICS Labs (Emerging Nanoscaled Circuits and Systems) at the Faculty of Engineering specializes in AI hardware acceleration, processing-in-memory (PiM), and content-addressable memory (CAM) architectures. The group has extensive, demonstrated expertise in AI-based metagenomic analysis of soil microbiomes, including the development of deep learning pipelines (transformer, CNN, RNN, and state space models) for taxonomic classification and functional annotation of complex microbial communities in environmental samples. EnICS Labs has developed proprietary computing platforms and taped out over 40 chips, including dedicated AI processors for bioinformatics. The group's research portfolio includes genome classification, pathogen detection, and real-time sequencing data analysis using Oxford Nanopore and other platforms. Leonid has 75+ publications and 16+ patents in AI hardware and computational genomics. EnICS researchers cumulatively have over 700 publications over the past 15 years.</p> |
| Type of organisation | Higher Education Institution / Research Organisation |
| List up to 5 keywords describing your sector or specialisation: | AI/deep learning for soil metagenomics, Soil microbiome analysis and classification, |

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| | Computational genomics and bioinformatics, Hardware-accelerated data analytics, Real-time environmental monitoring |
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Your experience

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| Have you already participated in an EU funded project? | Yes. Leonid Yavits is a participant in EIC Pathfinder Open 2021 project BioPIM (grant 101047160), whose objective is the development of a European bioinformatics processor. Leonid also participates in Israeli Swedish bilateral research collaboration (Lise Meitner Grants), and has submitted proposals under HORIZON Europe calls including EIC Transition. Leonid has extensive experience with international consortium building and collaborative research with European partners in the domains of AI hardware, computational genomics, and bioinformatics. |
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Your offered expertise and contribution

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| HEU call topic(s) of relevance | HORIZON-MISS-2026-05-SOIL-04: Leveraging long-term field experiments and other datasets to develop AI-ready decision support systems for sustainable soil management |
| Your offered contribution | We bring directly relevant, ongoing research in AI-based metagenomic analysis of soil microbiomes, which we propose to integrate into the project's AI-driven decision support system for sustainable soil management. Our specific contributions include: (1) AI-powered soil microbiome analysis as a soil health indicator: We are developing a metagenomic analysis platform combining transformer-based models, CNNs, RNNs, and state space models for taxonomic classification and functional annotation of complex soil microbial communities. This platform can process shotgun and long-read sequencing data (Oxford Nanopore, PacBio) from soil samples collected at Long-Term Field Experiment (LTE) sites, providing microbial diversity and functional capacity indicators directly relevant to soil health assessment and monitoring. |

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| | <p>(2) Open-source AI/ML tools for soil data analytics: We will develop open-source, modular AI components for analyzing complex, heterogeneous soil datasets, including metagenomic, physicochemical, and agronomic data from LTE networks. Our self-supervised learning approach enables taxonomy-free classification of novel microbial species (the “dark matter” of soil metagenomes), overcoming the limitation of incomplete reference databases that currently hinder soil microbiome characterization.</p> <p>(3) Real-time, field-deployable analysis for soil management decisions: Our platform integrates sequencing with deep learning-based real-time analysis, enabling adaptive soil monitoring. This capability can predict pollutant degradation pathways, antimicrobial resistance (AMR) markers, microbial community shifts, and biodegradation potential, providing actionable indicators for land managers and advisors making soil management decisions.</p> <p>(4) Predictive modelling for soil health: Using our expertise in de novo metagenomic assembly, probabilistic binning, and deep learning-based genome classification, we will contribute to building predictive models that link microbial community composition and functional profiles to soil health indicators, supporting evidence-based sustainable soil management strategies across pedo-climatic regions.</p> <p>Leonid’s team has a strong publication record in this domain (75+ papers, 16+ patents), including genome classifiers on chip (GCOC, IEEE TBCAS 2024), edit distance-tolerant pathogen detection (DIPER, IEEE TC 2023), and DNA classification architectures (DASH-CAM, IEEE/ACM MICRO 2023). We are currently developing an AI-based metagenomic analysis platform specifically designed for contaminated soil microbiomes, which can be directly extended and adapted for the sustainable soil management objectives of this call.</p> |
| <p>Your offered role (Coordinator, Work package leader or partner)</p> | <p>Work package leader (WP on AI/ML-based soil microbiome analysis and predictive modelling for soil health decision support, and hardware acceleration of these tasks if required)</p> |