ITEA 4




Project Results

# EARS

## Cross-system collaboration for recommendation systems

**Across domains such as e-commerce, media and healthcare, recommendation systems can benefit from shared learning. The ITEA project EARS (Environment Adaptive Recommendation System) therefore developed an explainable, artificial intelligence (AI)-powered recommendation platform that offers cross-system collaboration without revealing underlying data.**

Although the market for recommendation systems continues to grow, the systems themselves face challenges. Local streaming platforms, for instance, often rely on catalogues and popularity, leading to generic recommendations for many users. Personalisation is also slow for new users (the 'cold start' problem) and for new releases with limited interaction data. Additionally, local markets remain fragmented due to limited interoperability, dependence on foreign platforms, and strict data protection laws that constrain centralised AI adoption. To improve all of these aspects, a secure, culturally grounded recommendation ecosystem is required.

### Project developments

This is what EARS sought to accomplish with the development of a common recommendation platform that allows organisations from different domains to collaboratively and confidentially improve their recommendation services. Thanks to a federated learning architecture, only the algorithm outputs are shared and not the underlying data or models. This addresses the data privacy, cold start, and data sparsity problems of current recommendation engines. The platform also uses hybrid AI algorithms to combine different recommendation approaches and embeds explainability into recommendation models to increase user trust and system transparency. As a result of this approach, the architecture, federated learning mechanisms, explainability components, and integration interfaces are not restricted to a specific application. The project was instead designed around reusable, interoperable components that can be adapted to different sectors, as demonstrated in four use cases.




EARS consortium

In the media use case, EARS improves personalised content recommendations by allowing different media platforms to learn from complementary information without directly exchanging users' raw data. In healthcare, EARS supports professionals with personalised, explainable recommendations based on different sources of clinical information, while federated learning allows institutions to collaborate without centralising sensitive patient data. For hospital logistics, AI-based recommendation services were developed to support activities such as inventory management, material traceability, and operational decision-making. Finally, for e-commerce and content creation, EARS supports personalised product discovery and recommendation while providing tools that help content creators to better understand audience interests and preferences.
The consortium could then bring these independently developed components together into one platform with common interfaces for integrating different services.

### Results so far

Having validated the federated learning platform at TRL 6 in a controlled test environment with repeatable cycles, EARS has been shown to offer greater accuracy, transparency, and effectiveness to end users. Prediction errors, for example, are calculated periodically after each aggregation round – the point at which individual models from different clients are merged into a single global model – and the accuracy rate has been improved from 72% to 89%. This goes hand in hand with effectiveness: 100 rounds of federated learning were initially needed to reach 85% accuracy, but EARS has reduced this convergence speed to 71 rounds. In addition, six different recommendation engines are already supported within the federated learning architecture, demonstrating the scalability required to expand these results to other domains and applications beyond the initial scope of the project.

In the meantime, each EARS partner has developed a path to market, with six results already close to exploitation. For example, FTP will soon commercialise the 4YRECO plugin that translates the project's results into an e-commerce service that can be adopted by existing online stores for more personalised, explainable recommendations. Likewise, Square1 plans to integrate its recommendation engine into its content management system Publisher Plus, enabling editors to create content guided by privacy-preserving,

federated audience insights. In healthcare, meanwhile, Glintt aims to build on their existing network by releasing an oncology-oriented AI recommendation and decision-support service, potentially creating new AI-enabled services for hospitals. This solution is designed for integration within the EARS federated framework, enabling privacy-preserving use of sensitive healthcare data while supporting healthcare professionals with more accurate, contextualised, and trustworthy clinical decision support.

Hospital logistics also stands to benefit as Dextromedica has developed the AI-based recommendation framework DEXTRO-LH, which covers inventory, traceability, and operational decision support and offers potential software-as-a-service exploitation in hospital environments. Other partners are targeting multiple domains: ARD Group's production-oriented federated learning framework and simulation/test environment can be reused for privacy-preserving, multi-party AI applications beyond EARS and is already positioned for use in areas such as healthcare, municipal services, and e-government. For the consortium, these results offer greater competitiveness in a recommendation engine market that is expected to see a compound annual growth rate of at least 30% in each partner country for the remainder of the decade.

### Future outlook

In addition to commercialisation, EARS has been highly important in knowledge development and the building of partnerships: ten papers have been published, two AI experts have been hired across the consortium, and academic partner ISEP has seen four master's theses completed in relation to the project. Such dissemination positions the federated learning, explainability, and interoperability components as a basis for transferring the EARS approach to additional sectors in which organisations need to collaborate on AI while retaining control of their data. For instance, EARS is exploring collaboration with the ITEA project CAPE, potentially developing a scalable, privacy-preserving retail platform that can later be applied to other domains. EARS has therefore established both short and long-term viability, offering ways to exploit and reuse their modular technologies in new domains and services for years to come.

## Major project outcomes

### Dissemination

- Several publications: CENTERIS2025, The 5th International Workshop on Intelligent Systems, ASSS2025 Conference, The European Journal of Research and Development, Array Magazine
- Several conferences (2nd International Conference on Experimental and Computational Engineering Sciences Conference, ICECES 2024, IDSTA2025, WorldCIST 2026, International Conference on AI, Sustainability, Smart Technologies, and Societal Innovation)

### Exploitation (so far)

**New products:**

- SRS - Explainable and Privacy-Preserving Smart Recommendation System for Digital Publishers
- DEXTRO-LH – Explainable and Adaptive AI Recommendation Framework for Hospital Logistics
- Federated Learning Framework & ECSTA Simulation Testbed

**New services:**

- EARS Oncology AI Recommendation and Decision Support System
- Plugin 4YRECO

### Standardisation

- Complying with the following standards: WordPress Regulation, GDPR (EU) and KVKK (Türkiye), ISO/IEC 27001, OpenAPI and RESTful API standards, OAuth 2.0, OpenID Connect and JWT, Federated aggregation algorithms (FedAvg, FedAvgM, SCAFFOLD, TrimmedMean, FedAdan-m)

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# EARS

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**Partners**

*Portugal*

- FTP - Com. Equip. Inf. Lda
- Instituto Superior de Engenharia do Porto (ISEP)

*Spain*

- DEXTROMEDICA S.L.
- GLINTT HEALTCARE SL
- SQ1 WEB DEVELOPMENT SL

*Türkiye*

- Adesso Turkey Bilgi Teknolojileri Ltd. Şti.
- ARD GROUP
- DOGUŞ BILGI ISLEM VE TEKNOLOJI HİZMETLERİ
- DONANIM HABER ELEKTR.YAY.LTD. STI.

**Project start - end**

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