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SYNTHEMA Newsletter



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Dear Readers,

Welcome to the third edition of SYNTHEMA's newsletter, a vibrant update on our groundbreaking journey in the world of scientific innovation. In this issue, we delve into the exhilarating experiences and key insights from our participation in two major events: **the 65th American Society of Hematology (ASH) Annual Meeting 2023 and the Neural Information Processing Systems (NeurIPS) Conference 2023**. These platforms not only showcased our latest advancements but also enriched our understanding through collaborative learning and networking. Moreover, we are thrilled to share with you a series of publications that emerged from these events, offering a deeper dive into our research and findings.

We also present the SYNTHEMA project's focus groups, involving diverse healthcare AI stakeholders, provided valuable insights and ethical considerations for the responsible integration of AI in healthcare, emphasizing the balance between technology and human aspects.

Join us as we explore these milestones and continue our journey towards scientific excellence!

SYNTHEMA at NeurIPS 2023: Advancing Health with Deep Generative Models

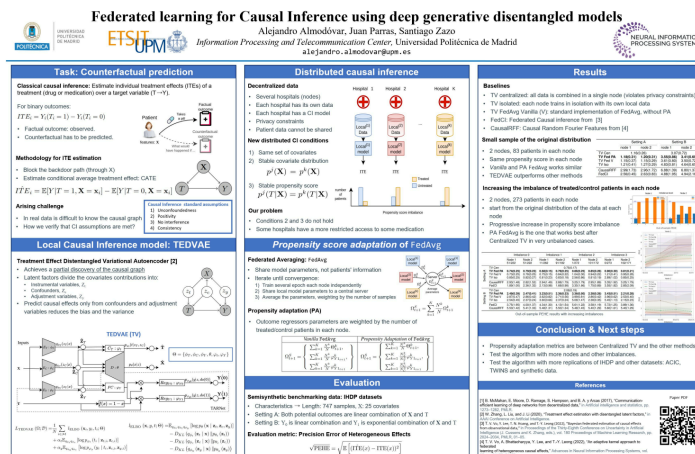
We are excited to announce our participation in the prestigious **NeurIPS 2023 Congress**, a landmark event in the field of artificial intelligence, held from December 10 to 16 at the Ernest N. Morial Convention Center in New Orleans. NeurIPS, renowned for its impact and standing alongside other AI giants like ICLR and ICML, offers a platform for researchers and practitioners to exchange groundbreaking ideas and advancements in AI.

This year, our partner, [Universidad Politécnica de Madrid](#) (UPM), represented by [Alejandro Almodóvar](#), took center stage at the Deep Generative Models for Health Workshop on December 15. Mr. Almodovar presented a compelling poster summarizing a recently published paper, "*Federated learning for causal inference using deep generative disentangled models*", that marks a significant stride in the application of deep generative models in healthcare, which is deeply related to the objectives of SYNTHEMA.

The workshop brought together a diverse group of academics, industry professionals, and healthcare experts, all united by a common goal: **leveraging AI to revolutionize healthcare**. The event provided an excellent opportunity for participants to engage with the latest research, methodologies, and applications of deep learning in health-related fields.

Our presence at NeurIPS 2023 underlines our dedication to staying at the forefront of AI research and development. It also highlights our commitment to fostering partnerships with leading academic institutions like UPM to drive forward the potential of AI in enhancing healthcare outcomes.

The feedback and insights gained from this event will undoubtedly propel our ongoing efforts to innovate and develop AI tools that are not only cutting-edge but also ethically responsible and beneficial to society. We look forward to continuing our journey in advancing healthcare through AI and contributing to a healthier, more informed world.



Poster presented by SYNHEMA consortium member UPM at NeurIPS23

Publication for NeurIPS : Federated learning for causal inference using deep generative disentangled models

Authors: Alejandro Almodóvar, Juan Parras, Santiago Zazo.

Published in: Deep Generative Models for Health Workshop @ NeurIPS 2023

Abstract: In the context of decentralized and privacy-constrained healthcare data settings, we introduce an innovative approach to estimate individual treatment effects (ITE) via federated learning. Emphasizing the critical importance of data privacy in healthcare, especially when drawing on data from various global hospitals, we address challenges arising from data scarcity and specific treatment assignment criteria influenced by the availability of the medication of interest. Our methodology uses federated learning applied to neural network-based generative causal inference models to bridge the gap between decentralized and centralized ITE estimation on a benchmark dataset

Read the full paper [here](#).

Insights and Ethical Considerations from the

SYNTHEMA Project's Focus Groups

Author: [Piercosma Bisconti, Ph.D.](#)

The **SYNTHEMA project**, an ambitious initiative aimed at integrating advanced artificial intelligence (AI) technologies into the healthcare sector, recently convened two pivotal focus groups. These groups were formed with a specific purpose: to gather diverse perspectives and insights from key stakeholders in the field of healthcare AI. Comprising technical and clinical experts, these focus groups were instrumental in shaping the project's direction and ensuring its alignment with the **ethical, practical, and societal dimensions** of AI application in healthcare.

SYNTHEMA's focus groups were composed mostly of consortium participants. The participants encompassed a broad demographic range in terms of age, gender, professional backgrounds, and expertise. Each focus group comprised approximately ten participants, ensuring a substantial and varied pool of perspectives. Separate focus groups were conducted to engage with two primary stakeholder categories: **technical partners** and **clinical experts**. These focus group sessions were carried out during the **M6 in-person meeting** held in Lisbon, providing an effective environment for open discussions.

The focus groups convened during the M6 in-person meeting held in Lisbon, marking a significant milestone in the SYNTHEMA project's timeline. The decision to hold these meetings in person, as opposed to virtually, was deliberate, aiming to foster a more personal and engaged discussion environment.

The primary intention behind these focus groups was to elicit detailed feedback on the SYNTHEMA platform from two critical perspectives: those developing the technology (technical partners) and those who would be its end-users in clinical settings (clinical experts). The project team recognized the importance of understanding the **unique concerns and expectations** of each group, which could significantly impact the platform's development and eventual adoption.

The discussions in these focus groups revolved around several core themes, guided by structured questions. The

focus group facilitator initiated the dialogue by presenting the "**Ethics Guidelines for Trustworthy AI**" established by the High-Level Expert Group on Artificial Intelligence in 2019. This set the stage for a nuanced conversation about how the SYNTHEMA platform could align with these ethical guidelines and contribute to **Sustainable Development Goals (SDGs)**. Participants were encouraged to imagine scenarios where the principles outlined in the guidelines might be challenged by the technology and to reflect on their potential concerns as either patients or physicians interacting with the platform.

The feedback received from these sessions was **invaluable**. Technical partners highlighted several ethical concerns, such as **accountability in AI decision-making, privacy risks**, and the need for transparency and explainability in AI systems. They also raised the issue of **non-discrimination and fairness**, particularly in the context of health data representation and the potential biases that could arise from data augmentation methods used by the platform. On the other hand, clinical partners focused more on the human aspect of AI usage, emphasizing the importance of **maintaining human oversight, clear communication** regarding data use, and the impact of AI on the physician-patient relationship.

One particularly striking revelation from the discussions was the extent to which **bias in AI and data privacy concerns** were prevalent across both groups, albeit from different perspectives. Technical partners delved into the specifics of technological solutions and safeguards, while clinical partners discussed these issues in the context of patient trust, and how to ensure it.

The insights gathered from these focus groups were not only **illuminating** but also somewhat surprising. The depth of concern over AI potentially replacing human judgment in clinical decision-making underscored the need for a **balanced approach** that respects and enhances the physician-patient relationship. It also highlighted the criticality of building trust in AI technologies among both clinicians and patients.

Given the richness of the discussions and the valuable feedback obtained, there are plans to conduct more focus groups as the SYNTHEMA project progresses. They have contributed significantly to the project by highlighting key

areas of concern that need to be addressed and by helping to shape the **ethical framework** within which the SYNTHEMA platform is being developed.

In conclusion, the focus groups organized by the SYNTHEMA project were a success, offering a **wealth of perspectives** that are crucial for the responsible and effective integration of AI in healthcare. The discussions not only reinforced the importance of considering a wide range of ethical and practical concerns but also highlighted the diversity of opinions and expectations among those at the forefront of healthcare technology. As the project moves forward, the insights gained from these focus groups will be **instrumental** in guiding its development, ensuring that the SYNTHEMA platform is not only technologically advanced but also ethically sound and aligned with the needs and concerns of its users.



SYNTHEMA at 65th Annual American Society for Hematology Meeting in San Diego

SYNTHEMA, represented by consortium members [Humanitas Research Hospital](#) and [Alma Mater Studiorum – Università di Bologna](#), made a significant contribution at the 65th ASH Annual Meeting and Exposition in San Diego. This premier event in classical and malignant hematology, held from December 9-12, 2023, was a blend of in-person and online sessions. The meeting included a variety of scientific and educational programs, specialized workshops, symposia, and sessions focusing on diverse aspects of hematology.

SYNTHEMA's representatives showcased groundbreaking work in the field of hematology. They presented their latest research on generating histopathological synthetic images using stable diffusion models and variational autoencoders, particularly focusing on Acute Myeloid Leukemia (AML). This innovative approach utilized data from Tazi et al's paper, offering new insights into AML classification and risk stratification.

Additionally, the team validated their dataset by extracting morphological and texture features from synthetic images, comparing them to real images to predict critical statistics like Overall Survival and Progression-Free Survival. This methodology extended to sequencing synthetic data, where they employed Dirichlet clustering and Markov models for state transitions, benchmarking their results against actual data.

SYNTHEMA also highlighted their work on Sickle Cell Disease (SCD), employing a dual approach on available Brain MRI data of SCD patients. They generated synthetic images and features, comparing these with real data to ensure accuracy and reliability. Their presentations and contributions to the meeting emphasized the role of advanced computational techniques in enhancing our understanding and treatment of hematological disorders, marking a significant step forward in medical research and patient care.



SYNTHEMA consortium representatives at the ASH23

Publication: Clinical Text Reports to Stratify Patients Affected with Myeloid Neoplasms Using Natural Language Processing

Authors: Gianluca Asti, Elisabetta Sauta, Nico Curti, Gianluca Carlini, Lorenzo Dall'Olio, Luca Lanino, Giulia Maggioni, Alessia Campagna, Marta Ubezio, Antonio Russo, Gabriele Todisco, Cristina Astrid Tentori, Pierandrea Morandini, Marilena Bicchieri, Maria Chiara Grondelli, Matteo Zampini, Erica Travaglino, Victor Savevski, Nicolas Riccardo Derus, Daniele Dall'Olio, Claudia Sala, Lin-Pierre Zhao, Armando Santoro, Shahram Kordasti, Valeria Santini, Anne Sophie Kubasch, Uwe Platzbecker, Maria Diez-Campelo, Pierre Fenaux, Amer M. Zeidan, Torsten Haferlach, Gastone Castellani, Matteo Giovanni Della Porta, Saverio D'Amico

Published in: 65th ASH Meeting in San Diego
|803.EMERGING TOOLS, TECHNIQUES AND ARTIFICIAL INTELLIGENCE IN HEMATOLOGY

Abstract: This study, spearheaded by [GenoMed4All](#) and Synthema EU consortia, showcases the **development of HematoBERT, an AI language model tailored for the hematology domain**. Utilizing the BERT framework, HematoBERT was fine-tuned with hematological clinical reports, focusing on diseases like myeloproliferative neoplasms, myelodysplastic syndrome, and acute myeloid leukemia. This model successfully clustered patients based on their clinical reports, revealing significant insights into patient stratification and prediction of clinical outcomes. HematoBERT demonstrated superior performance in understanding contexts and correlations compared to pre-trained non-contextualized models, highlighting its potential in enhancing personalized medicine through the integration of clinical and genomic data.

Read the full paper [here](#)

Publication: Synthetic Histopathological Images Generation with Artificial Intelligence to Accelerate Research and Improve Clinical Outcomes in Hematology

Authors: Gianluca Asti, Saverio D'Amico, Nico Curti, Gianluca Carlini, Elisabetta Sauta, Nicolas Riccardo Derus, Daniele Dall'Olio, Claudia Sala, Lorenzo Dall'Olio, Luca Lanino, Giulia Maggioni, Alessia Campagna, Marta Ubezio, Antonio Russo, Gabriele Todisco, Cristina Astrid Tentori, Pierandrea Morandini, Marilena Bicchieri, Maria Chiara Grondelli, Matteo Zampini, Victor Savevski, Armando Santoro, Shahram Kordasti, Valeria Santini, Anne Sophie

Kubasch, Uwe Platzbecker, Maria Diez-Campelo, Pierre Fenaux, Lin-Pierre Zhao, Amer M. Zeidan, Torsten Haferlach, Gastone Castellani, Matteo Giovanni Della Porta

Published in: 65th ASH Meeting in San Diego
J803.EMERGING TOOLS, TECHNIQUES AND ARTIFICIAL INTELLIGENCE IN HEMATOLOGY

Abstract: In this groundbreaking paper by [GenoMed4All](#) and Synthema EU consortia, the focus was on utilizing AI to generate synthetic hematological images from textual data, **addressing the challenges in collecting multimodal data for rare and complex hematological malignancies.**

The initiative involved applying the Stable Diffusion generative model, fine-tuned with hematological data, to create Hematoxylin and Eosin images for myeloid neoplasm patients. This was complemented by HematoBERT, a domain-specific language model encoding textual inputs to condition image generation. The study also **developed a Synthetic Images Validation Framework (SIVF)** to evaluate the utility and fidelity of these synthetic images. The results showed that synthetic data significantly enhanced disease classification and prediction of survival probabilities, with synthetic augmentation improving model performances by over 10%. This innovative approach demonstrated the potential of AI-generated images in replicating real-world morphological features, thereby boosting precision medicine research in hematology through effective data augmentation and simplified data sharing.

Read the full paper [here](#)

Next Steps

As we progress further into the SYNTHEMA project journey, the next steps are both exciting and crucial. A key milestone on our roadmap is an upcoming in-person consortium meeting, a gathering that promises to be a significant event. During this meeting, various working packages will present the work accomplished thus far, showcasing the strides we have made in integrating AI technologies into healthcare. This will not only foster a collaborative spirit but also provide a platform for knowledge sharing and feedback.

Our sister project [GenoMed4All](#) will also be hosting an in-person consortium meeting in Barcelona that same week,

which will give us all the opportunity to get together and continue exchanging ideas for the advancement of both initiatives.

In tandem with these presentations, we are thrilled to announce the creation of our first project video trailer. This trailer will serve as a dynamic and engaging medium to highlight the achievements of the first year of the project. It's designed to encapsulate the essence of our work, our challenges, and our successes, providing a visually compelling narrative of our journey so far.

Another key element in our communication strategy is the dissemination of insights about WP5 through a written article. This article aims to delve deeper into the specifics of WP5, offering a detailed and informative perspective on its progress and impact.

Beyond these immediate steps, we have a robust pipeline of other publications and events planned. These endeavors are not just about sharing our progress; they are about engaging with the wider community, sparking discussions, and gathering diverse perspectives that can enrich our project. We are committed to maintaining transparency and fostering a culture of continuous learning and improvement.

In summary, the next phase of the SYNTHEMA project is filled with opportunities for growth, collaboration, and outreach. Each of these steps, from the consortium meeting to the creation of multimedia content and publications, is geared towards not only advancing our project but also ensuring its alignment with the broader goals of ethical and effective AI integration in healthcare. We look forward to sharing these developments and continuing our journey with vigor and commitment.

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🌟 Exciting News from SYNTHEMA: Dive into Our 3rd Newsletter! 🌟
🔍 Discover the Latest in AI & Healthcare Innovation!

Dear LinkedIn Community,
We're thrilled to invite you to explore the third edition of SYNTHEMA's newsletter, where innovation meets insight! Join us as we recount our exhilarating journey through two landmark events: the 65th ASH Annual Meeting 2023 and the NeurIPS Conference 2023. 🌐 🌟

👉 Collaboration & Insight:
Learn from our Focus Groups, involving diverse healthcare AI stakeholders, as we

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