REALM HEALTHCARE PLATFORM

Secure Health Insights: An AI-driven system that enhances medical data accuracy and insights while ensuring strict privacy controls.

REALM

COLLABORATIVE AI FOR HEALTHCARE

Anonymity

Confidentiality

Realm Health Connect is an innovative platform designed for healthcare, focusing on **collaboration** and privacy. It uses AI to help healthcare providers work together safely, ensuring compliance and protecting patient privacy. This tool is key for improving care and trust in healthcare technology.

Security

Verifiability

Compliance

BRIDGING THE DATA GAP IN AI-DRIVEN HEALTHCARE

Addressing the critical balance between the need for vast amounts of healthcare data for AI advancements and the imperative of protecting patient privacy.

PROBLEM 1

Critical Data Need vs. Privacy: AI's potential in healthcare hinges on access to large datasets, yet stringent privacy regulations and the intrinsic value of real patient data create significant barriers.

Synthetic Data as a Solution: Introducing synthetic data that mirrors real patient information can drive AI research and development forward without compromising individual privacy.

Realm Health Connect Approach: Facilitates AI innovation in healthcare by providing high-quality synthetic data, ensuring both compliance with privacy laws and the advancement of medical research.

FOSTERING COLLABORATION ACROSS THE HEALTHCARE ECOSYSTEM

Eliminating the technological void that hampers collaborative AI model development among healthcare's diverse stakeholders.

COLLABORATION HELTHCARE AI

PROBLEM 2

Need for Unified Collaboration: The absence of a platform for secure, efficient collaboration among researchers, clinicians, and institutions slows down healthcare innovation.

Realm Health Connect as the Catalyst: Offers a dedicated environment for secure data sharing and collaborative model training, propelling cross-disciplinary innovation.

Breaking Down Silos: By enabling seamless interaction, Realm Health Connect accelerates the translation of AI research into clinical practice, benefiting the entire healthcare continuum.

STREAMLINING AI ADOPTION IN CLINICAL SETTINGS

Tackling the dual challenges of AI model complexity and healthcare conservatism to enhance AI adoption in clinical environments.

PROBLEM 3

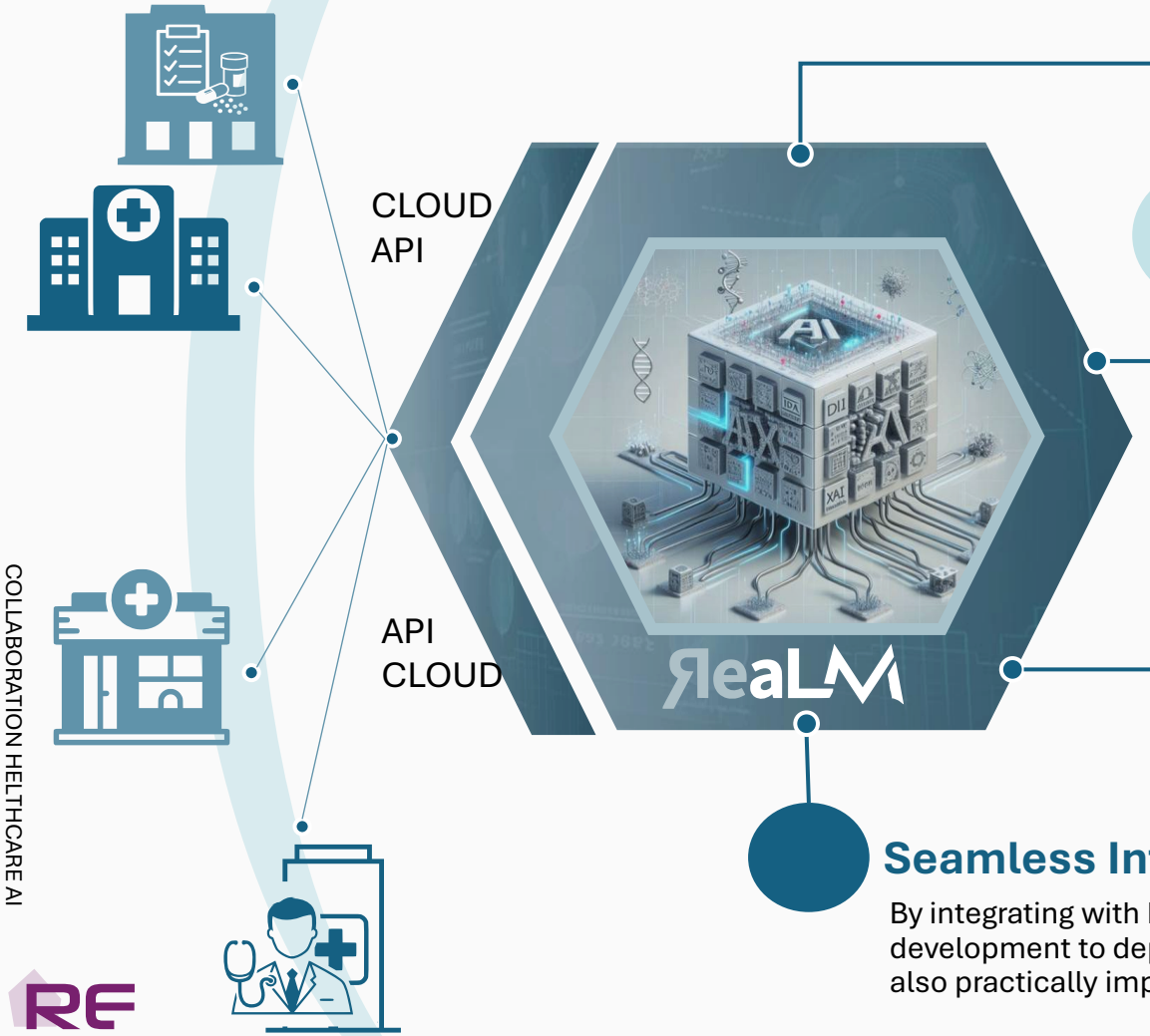
Complexity and Interpretability Issues: The intricate nature of AI models often leads to interpretability challenges, hindering their acceptance and deployment in sensitive medical contexts.

Reducing Implementation Barriers: Realm Health Connect emphasizes explainable AI to make models more accessible and understandable for healthcare professionals, fostering trust and adoption.

Navigating Conservatism with Confidence: By providing clear, interpretable, and reliable AI solutions, Realm Health Connect addresses conservative attitudes towards technology in healthcare, facilitating smoother integration and acceptance.

SOLUTION: COLLABORATIVE AI FRAMEWORK IN HEALTHCARE

Health Connect introduces a collaborative AI framework designed to tackle healthcare's biggest challenges, seamlessly combining synthetic data, federated learning, and explainable AI to foster innovation, privacy, and trust.



Synthetic Data Empowerment

At the heart of Realm Health Connect is its use of OpenFL for federated learning, allowing healthcare entities to collaboratively develop and refine AI models without sharing sensitive data. This fosters a culture of collaboration, accelerating collective advancements in healthcare while maintaining the utmost privacy and security standards.

Collaborative Learning with OpenFL

By leveraging PATE-GAN, Realm Health Connect generates synthetic datasets that replicate the complexity and diversity of real patient data, enabling robust AI training without privacy risks. This foundation supports a collaborative AI ecosystem where innovation thrives on accessibility and compliance, crucial for groundbreaking developments in treatments and drug discovery.

Transparent AI through SHAP and LIME

Incorporating explainable AI techniques, such as SHAP and LIME, Realm Health Connect ensures that AI's decision-making processes are transparent and interpretable. This transparency is essential for gaining the trust of healthcare professionals and patients alike, making AI a reliable tool in clinical decision-making.

Seamless Integration via MLFlow

By integrating with MLFlow, Realm Health Connect streamlines the lifecycle management of AI models, from development to deployment. This ensures that collaborative AI projects are not only technically feasible but also practically implementable, bridging the gap between innovative research and everyday clinical practice.

DEEP DIVE INTO TECHNOLOGICAL INNOVATIONS

Realm Health Connect (RHC) seamlessly integrates synthetic data generation using PATE-GAN, federated learning through Open FL, and explainable AI with tools like SHAP and LIME, all orchestrated under the robust management system of MLFlow.

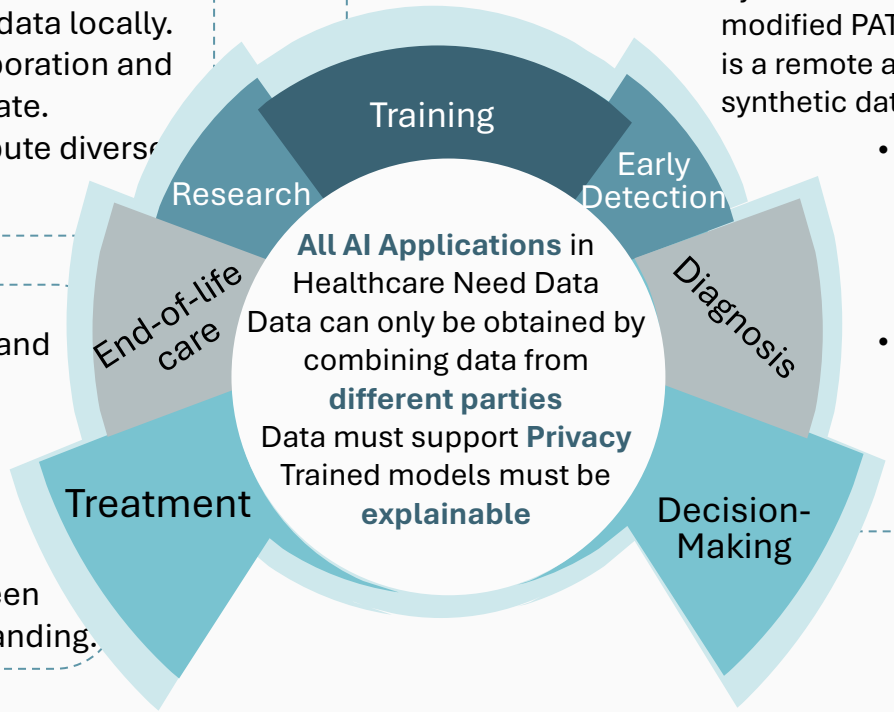
Unlike traditional healthcare AI solutions, which often operate in silos, focus on singular aspects of AI application, or struggle with data privacy and model interpretability, Realm Health Connect provides a holistic, integrated approach. While many platforms offer pieces of the puzzle, our framework delivers a comprehensive solution addressing privacy, collaboration, and transparency simultaneously.

Federated Learning (OpenFL)

- FL enables collaborative model training across distributed data sources (e.g., hospitals, clinics).
- It preserves data privacy by keeping raw data locally.
- The value depends on the scale of collaboration and the willingness of institutions to participate.
- High value if multiple institutions contribute diverse data for improved model accuracy.

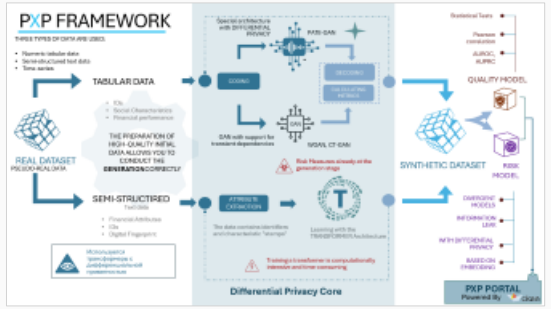
Explainable AI (XAI)

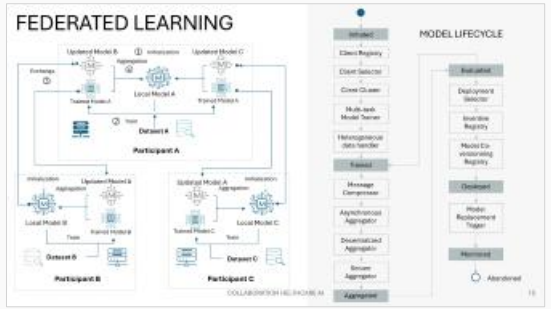
- XAI techniques provide transparency and interpretability.
- Clinicians and stakeholders need to understand model decisions.
- XAI fosters trust, adoption, and accountability.
- Its value lies in bridging the gap between complex models and human understanding.



Synthetic Data with PATE-GAN

- Synthetic data addresses critical challenges related to privacy and data scarcity.
- Synthetic data is created based on the modified PATE-GAN framework, which is a remote agent that creates synthetic data based on real data.
- Such synthetic data can be uploaded to a special library. It allows model training without exposing real patient information.
- By mimicking real-world distributions, synthetic data enhances model robustness and generalization.

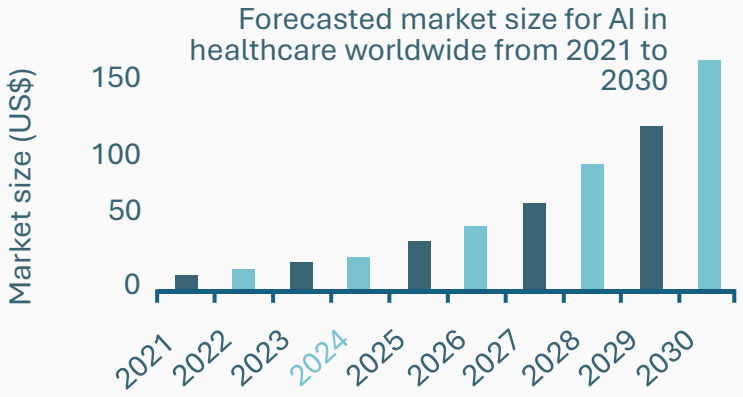




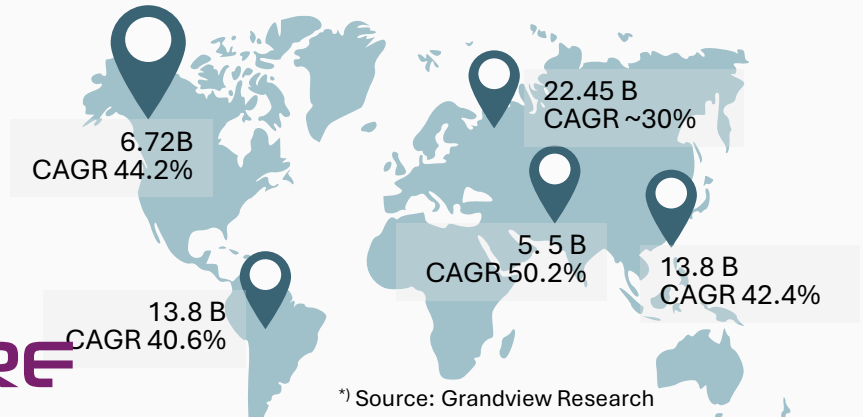
MARKET OPPORTUNITY

The next decade will witness a remarkable surge in AI within healthcare, fueled by the urgent need to address the system's declining efficiency and the critical shortage of healthcare professionals. AI's promise to revolutionize drug discovery, diagnostics, and process optimization positions it as a key solution to these challenges. Despite potential hurdles, solutions that effectively leverage AI to overcome these obstacles will capture a significant competitive advantage, marking a pivotal shift towards a more efficient and advanced healthcare ecosystem.

As of 2023, the global AI in healthcare market size was estimated at USD 22.45 billion. The global healthcare AI market is forecasted to be worth nearly USD 188 billion by 2030, growing at a CAGR of 37% from 2022 to 2030

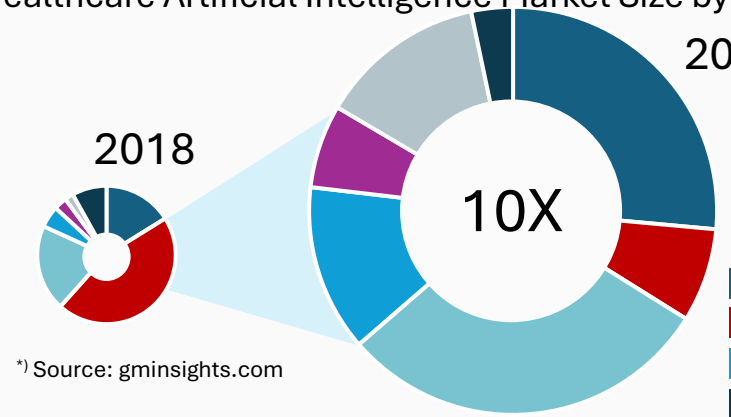


*) Source: Statista



*) Source: Grandview Research

US Healthcare Artificial Intelligence Market Size by Application (2018 & 2025), USD Million



*) Source: gminsights.com

AI thrives on secure, high-quality data - and it demands it in abundance.

- Medical Imaging & Diagnosis
- Hospital Workflow
- Therapy Planning
- Others
- Drug Discovery
- Wearables
- Virtual Assistants

MARKET DRIVERS FUELING AI IN HEALTHCARE

Expanding Data: The digitalization of patient health information has grown exponentially, with over 2.5 exabytes of data generated each day globally. This vast pool of digital data is a goldmine for AI, enabling deeper, more accurate insights into patient health and disease patterns.

Personalized Medicine: The demand for personalized treatment is skyrocketing, driven by the success of AI in identifying individual patient needs and tailoring therapies accordingly. This approach not only enhances patient outcomes but also optimizes resource allocation across healthcare systems.

Cost Reduction: AI's role in streamlining diagnostics, treatment planning, and patient monitoring is projected to save the healthcare industry billions annually. By automating routine tasks and enhancing decision-making, AI is a pivotal player in reducing operational costs.

Aging Population: With over 700 million people globally over the age of 65, the need for efficient, early disease diagnosis and management is more critical than ever. AI's predictive capabilities are essential for addressing the complex health needs of this growing demographic.

Chronic Disease Management: Chronic diseases account for 70% of deaths worldwide, necessitating innovative approaches for management and treatment. AI models excel in identifying disease patterns and predicting outcomes, offering hope for more effective chronic disease management.

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Pandemic Response Acceleration: The COVID-19 pandemic served as a catalyst for AI adoption in healthcare, demonstrating its capability in rapid diagnosis and efficient management of health crises. AI's role in tracking, predicting, and managing outbreaks has underscored its indispensable value in public health.

COLLABORATION HELTHCARE AI

KEY CHALLENGES & CONSIDERATIONS

Data Growth and Silos: The healthcare sector is experiencing an exponential increase in data, with estimates suggesting that healthcare data is growing at a rate of 48% annually. This surge, coupled with the issue of data silos and IT system isolation, complicates data management and integration, hindering the seamless use of AI across different healthcare platforms.

Ecosystem Collaboration: Effective collaboration across the healthcare ecosystem, including pharmaceuticals, research institutions, and AI developers, is pivotal. For example, AI can significantly accelerate drug discovery processes, but this requires seamless partnership and data sharing, a complex endeavor given the diverse interests and data governance concerns of each entity.

Regulatory Pressure and Compliance: The regulatory landscape for AI in healthcare is becoming increasingly complex, with key legislations including:

USA: HIPAA for patient data privacy, FDA for AI-based medical devices, and the Algorithmic Accountability Act for transparency and ethics.
Canada: PIPEDA for privacy, and the new AIDA focusing on AI development and privacy enhancement.
Europe: GDPR for data handling, with the EU's AI Act pioneering comprehensive AI regulation.

User Expectations for Personalization: Users demand highly personalized healthcare services, from apps for health management to treatments tailored to their genetic profiles. Meeting these expectations with AI requires sophisticated algorithms that can adapt to individual user data while ensuring privacy and security.

AI Explainability and Operational Costs: The challenge of using AI without clear explanations of its decision-making processes is significant. For instance, in diagnosing rare diseases, AI can identify patterns unseen by human eyes but explaining the 'why' behind its conclusions is crucial for clinician acceptance. Moreover, deploying AI solutions can be expensive, with costs including data preparation, algorithm training, system integration, and ongoing maintenance. These costs can be substantial, often requiring significant upfront investment and long-term financial planning.

Shortage of AI Specialists: Despite the growing demand for AI in healthcare, there's a notable gap in qualified professionals. From May 2018 to May 2019, AI job listings on Indeed grew by 29%, yet searches for AI-related roles decreased by 14.5%, indicating a mismatch between the demand for AI expertise and the available talent pool.

Addressing Bias and Ethical Considerations: The healthcare industry must confront and correct biases in AI algorithms to prevent disparities in patient care. Additionally, balancing innovation with ethical considerations remains a constant challenge, requiring ongoing dialogue and regulation to ensure AI's benefits are equitably distributed.

BUSINESS MODEL

Realm Health Connect introduces a groundbreaking business model designed to revolutionize healthcare through Collaborative AI. By focusing on secure data sharing, model integration, and democratization via explainable AI (XAI), we offer healthcare organizations a suite of tools and services tailored to their unique needs, ensuring confidentiality, efficiency, and advanced AI utility.

Collaborative AI Platform Subscription: Organizations can subscribe to our platform for $150 per workplace for 12 months, gaining access to a customizable tool that mirrors the successful models of PowerBI and ASANA. This approach guarantees data confidentiality and seamless model integration within a secure, contextual framework.

Customization and Advisory Services: Beyond the core platform, we provide specialized advisory services for configuring routing, developing tailored models, and ensuring optimal platform utilization, catering to the specific needs of healthcare organizations.

Secure API Development: A dedicated layer of secure APIs enables healthcare organizations to connect their internal systems to our platform, facilitating safe data exchange and integration with existing IT infrastructures.

Out staffing AI Specialists: Addressing the acute shortage of AI professionals in the industry, our model includes offering out staffing services, providing healthcare organizations with the expert personnel needed to manage and optimize AI solutions effectively.

Hyper-Local Personalized Services: Our platform supports hyper-local personalized services, including a white label mobile application and API services. These features allow for storing secure models, evaluating and integrating them, and incorporating third-party modules, enhancing the collaborative AI ecosystem.

Democratization Through XAI: Emphasizing the importance of transparency and understanding in AI applications, our business model prioritizes the democratization of AI through explainable AI techniques. This ensures that healthcare organizations can not only use AI effectively but also understand and trust the processes behind AI-driven decisions.

2025-02-15

COMPETITIVE LANDSCAPE: REALM HEALTH CONNECT VS. MARKET PLAYERS

Dive into the competitive landscape of AI in healthcare, comparing Realm Health Connect with other significant players. This comparison highlights key differences in focus areas, technologies used, and the unique strengths and challenges of each solution, showcasing Realm Health Connect's position in the evolving healthcare AI market.

Parameter	Realm Health Connect	Remedy Health	Subtle Medical	NetBase Quid	IBM Watson Health	Google DeepMind Health	Tempus
Founded Year	2018	2018	2016	Not specified	2015	2010	2015
Product Focus	Collaborative AI platform with secure data sharing and XAI	Privacy-preserving FL and XAI solutions	Enhancing medical imaging with synthetic data and FL	NLP solutions for healthcare	Cognitive computing for health data analysis	AI research in health data analysis	Precision medicine through data analytics
Technology	Synthetic data, FL, XAI	Synthetic data, FL, XAI	Synthetic data, FL	NLP, semantic analysis	Cognitive computing, data analytics	Machine learning, data analysis	Big data analytics, machine learning
Market Focus	Healthcare organizations, collaborative research	Personalized medicine, patient monitoring	Radiology, diagnostics	Healthcare analytics, patient sentiment	Clinical decision support, operational efficiency	Predictive health analytics	Personalized treatment plans
Partnerships & Collaborations	Accenture University of Toronto LifeLabs Canada Royal Victoria Regional Health Centre	Partnerships with healthcare providers for pilot projects	Collaborations with radiology departments	Partnerships for data analytics in healthcare	Broad healthcare and research partnerships	Collaborations with NHS and other health organizations	Strategic partnerships with healthcare providers
Innovation & Research	Continuous development in collaborative AI and XAI	Focus on privacy-preserving AI technologies	Advancements in AI for medical imaging	NLP innovations for healthcare applications	Extensive research in AI for health data	Leading AI research for health	AI-driven insights for precision medicine
Regulatory Approvals	Complies with healthcare data privacy standards	HIPAA compliant, working towards FDA approvals	FDA approvals for specific imaging solutions	Focus on GDPR and HIPAA compliance	FDA cleared solutions for health data analysis	Engaging with regulatory bodies for compliance	FDA approvals for diagnostic tools
Unique Selling Proposition (USP)	Democratizing AI in healthcare with a focus on collaboration and transparency	Innovative approach to federated learning and synthetic data	Cutting-edge technology in medical imaging	Expertise in NLP for unstructured healthcare data	Pioneering cognitive computing in healthcare	Applying groundbreaking AI research to healthcare	Leading in precision medicine analytics
Future Roadmap	Expanding collaborative AI features, enhancing explainability and integration	Developing new FL models for broader healthcare applications	Extending imaging technology to more specialties	Expanding NLP capabilities for deeper healthcare insights	Advancing AI applications in clinical and operational health	Broadening the scope of predictive analytics in healthcare	Scaling precision medicine solutions across diseases

Key Competitive Advantages

Collaborative AI Framework:

Realm Health Connect's platform is uniquely designed to foster secure and efficient collaboration across the healthcare ecosystem, differentiating it from competitors that offer more singular or isolated solutions.

Explainable AI (XAI):

The platform's commitment to explainable AI is a significant advantage, as it increases the transparency of AI decisions. This is crucial for healthcare professionals who need to understand the basis of AI recommendations to trust and effectively use them in patient care.

Adaptability to Healthcare Needs

Realm Health Connect's design for seamless integration and customization makes it a versatile tool for a wide range of healthcare applications, from advanced research to direct patient care, ensuring its utility across the healthcare spectrum.

GO-TO-MARKET STRATEGY

Our Go-To-Market (GTM) strategy is meticulously crafted around the core principles of forging strategic partnerships, leveraging cutting-edge technology, and diversifying usage modes to ensure seamless integration and widespread adoption. By focusing on establishing strong relationships with key market participants, including scientific organizations, medical institutions, and leading analytical firms, and by harnessing the expertise of AI specialists, we aim to address the urgent needs of the healthcare sector.

Forge Strong Industry Partnerships

Establish robust partnerships with universities, hospitals, research institutions, and pharmaceutical companies, alongside collaborations with large analytical firms like Deloitte, Accenture, and PWC. These alliances will enable the integration of cutting-edge research, clinical insights, and business intelligence, enhancing the platform's capabilities and market penetration.

Strategic Distribution Partnerships

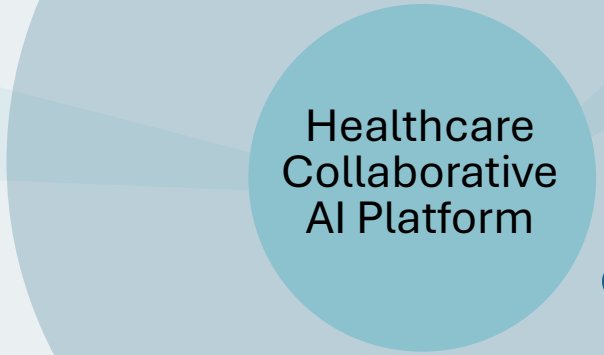
Partner with existing healthcare software vendors like Healthcare Excellence Canada, McKinsey, and EPAM to distribute the solution more broadly. Inviting these partners to join the advisory board will deepen relationships and align strategic interests, facilitating smoother integration into the healthcare ecosystem.

Influencer Engagement for Brand Building

Attract influencers and thought leaders in the healthcare and technology sectors to advocate for Realm Health Connect. Leveraging their networks and credibility will help build the brand's reputation, increase awareness, and establish Realm Health Connect as a leader in the healthcare AI space.

Diversify Tool Utilization

Offer the platform through various channels, including SDKs, APIs, and ready-to-use software, to cater to different user preferences and integration needs. This flexibility will allow healthcare organizations to easily adopt and integrate Realm Health Connect into their existing systems.



Technological Collaborations

Cultivate technological partnerships with development teams and AI researchers to stay at the forefront of AI advancements. This collaborative approach will ensure that Realm Health Connect remains innovative, adaptable, and capable of addressing complex healthcare challenges.

Tailored Sales Approaches

Utilize consulting and the provision of AI specialists as key sales strategies to address the acute market need for expertise in AI. This tailored approach will not only solve the immediate challenges faced by healthcare organizations but also position Realm Health Connect as an indispensable partner in their AI journey.

Ecosystem Formation via White Label Application

Develop a white label application that offers secure data storage and processing, tailored to meet the needs of specific locales and organizations. This strategy will enable healthcare providers to offer personalized, AI-driven services to their patients, fostering a strong, user-centric ecosystem.

THANK YOU

APPENDIX

PXP FRAMEWORK

THREE TYPES OF DATA ARE USED:

- Numeric tabular data
- Semi-structured text data
- Time-series

REAL DATASET
PSEUDO-REAL DATA

TABULAR DATA

- IDs
- Social Characteristics
- Financial performance

THE PREPARATION OF HIGH-QUALITY INITIAL DATA ALLOWS YOU TO CONDUCT THE **GENERATION**CORRECTLY

SEMI-STRUCTIRED
Text data

- Financial Attributes
- IDs
- Digital Fingerprint

Используется трансформеры с дифференциальной приватностью

Special architecture with DIFFERENTIAL PRIVACY

PATE-GAN

CODING

DECODING

CALCULATING METRICS

GAN

GAN with support for transient dependencies

WGAN, CT-GAN

Risk Measures already at the generation stage

ATTRIBUTE EXTRACTION

The data contains identifiers and characteristic "stamps"

Learning with the TRANSFORMER Architecture

Training a transformer is computationally intensive and time-consuming

Differential Privacy Core

Statistical Tests

Pearson correlation

AUROC, AUPRC

QUALITY MODEL

SYNTHETIC DATASET

RISK MODEL

DIVERGENT MODELS

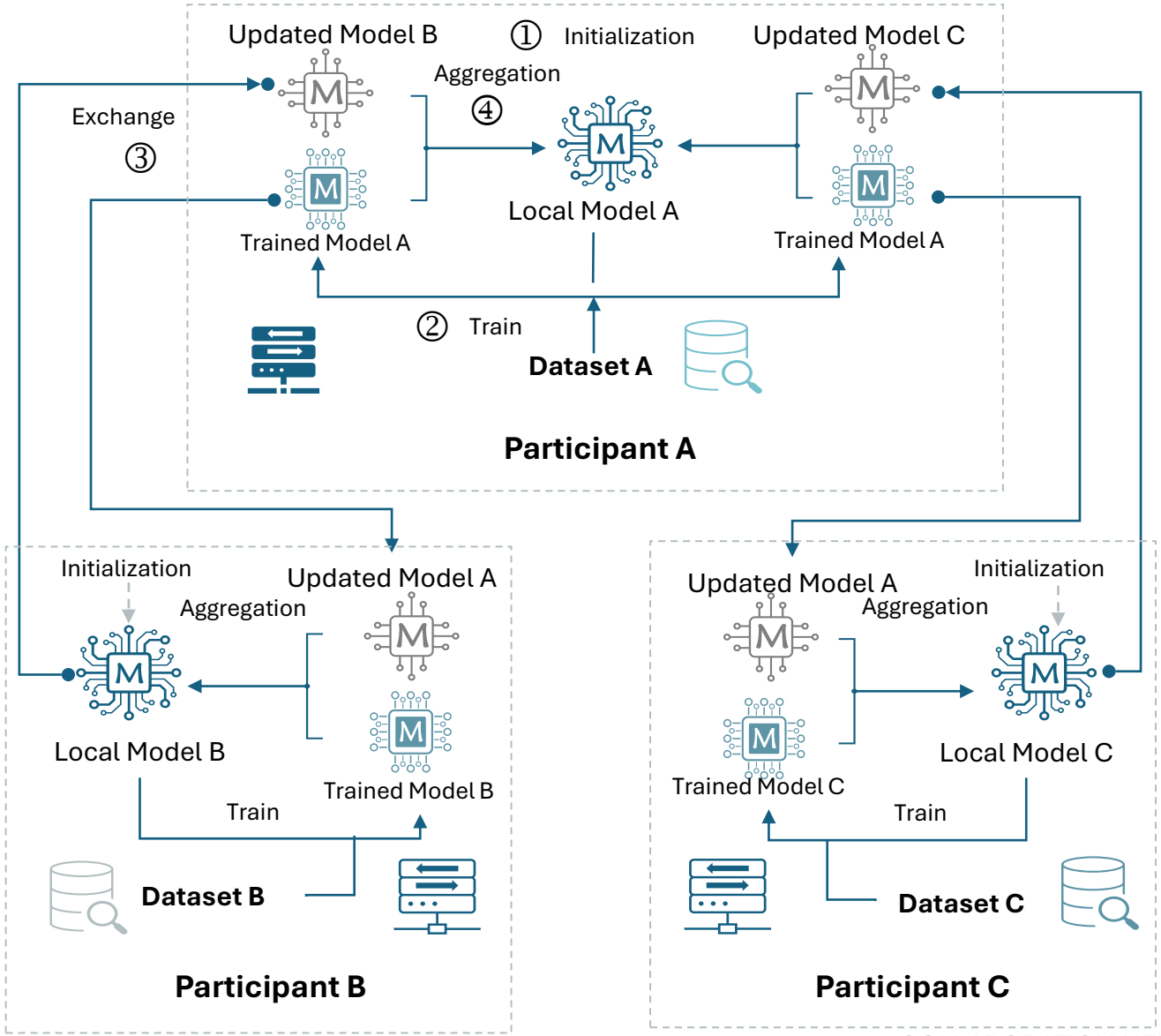
INFORMATION LEAK

WITH DIFFERENTIAL PRIVACY

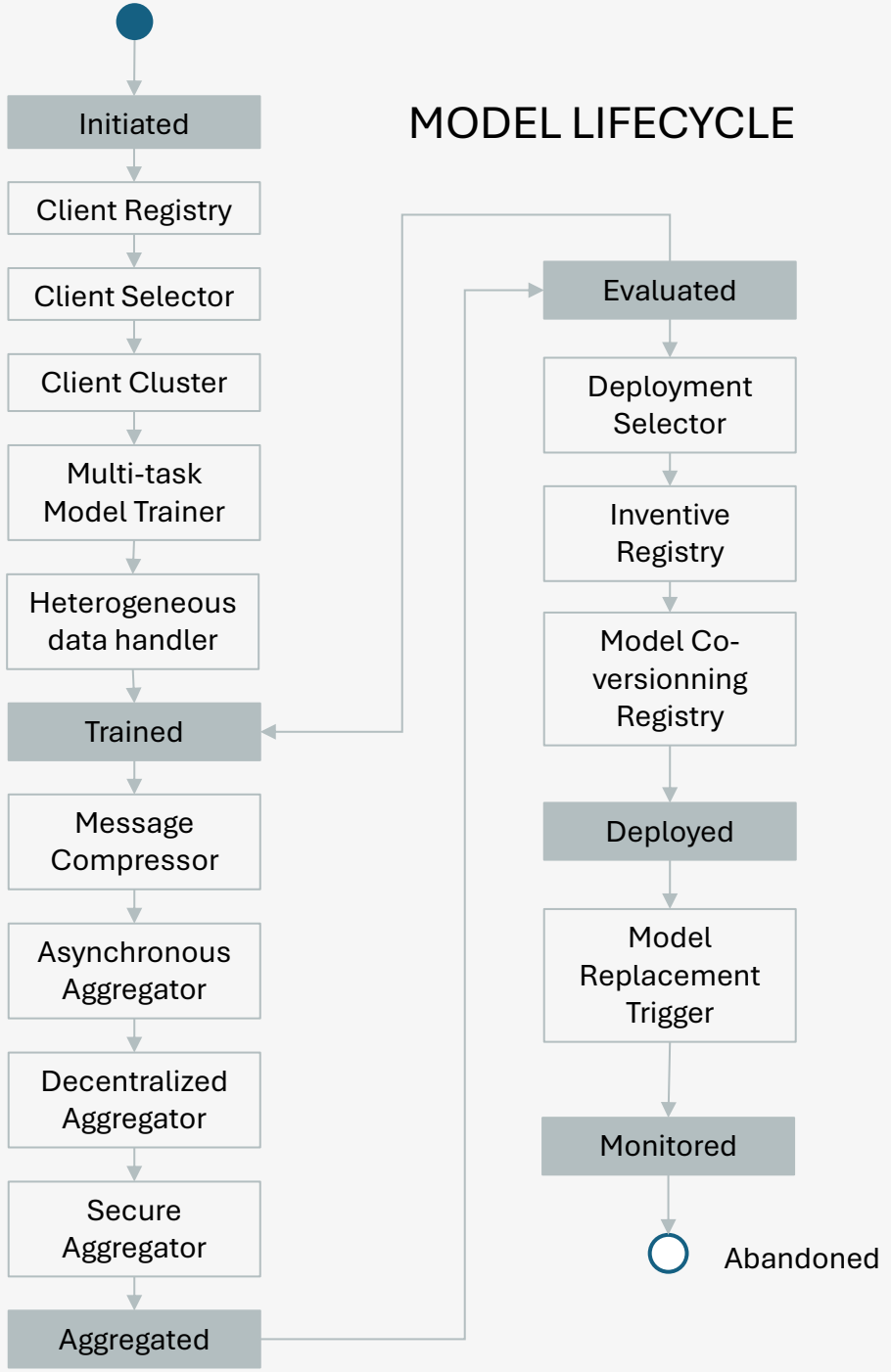
BASED ON EMBEDDING

PXP PORTAL
Powered By ckan

FEDERATED LEARNING

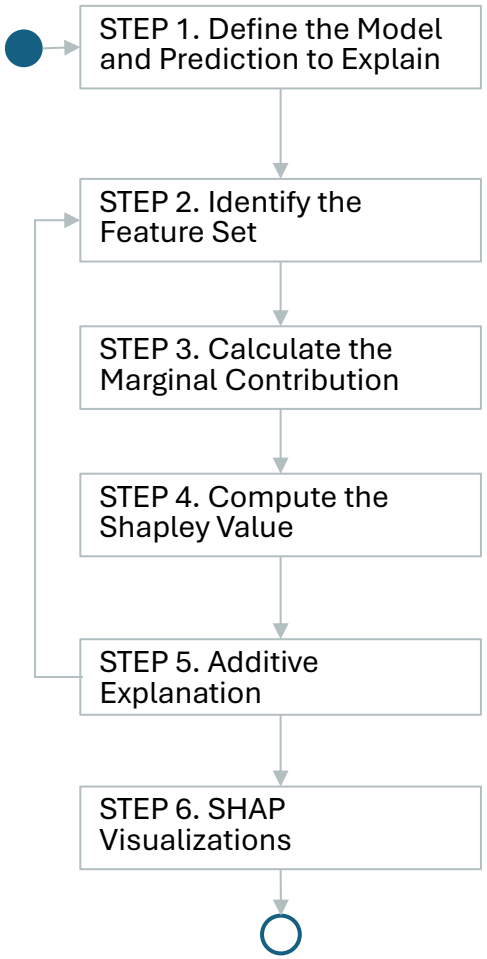


MODEL LIFECYCLE



XAI: SHAP

SHAP (SHapley Additive exPlanations) is a cutting-edge, model-agnostic tool designed to explain the output of any machine learning (ML) model. It utilizes game theory principles, particularly Shapley values, to allocate an "importance" value to each feature for a given prediction. Essentially, SHAP breaks down a model's prediction into the contribution of each feature, thereby offering a detailed explanation of how each feature influences the prediction. This transparency is vital for understanding, trusting, and effectively using AI models.



Let f be the model you want to explain, and x be a specific instance (data point) with features $[x_1, x_2, \ldots, x_n]$ for which you want to explain the model prediction $f(x)$.

Consider all subsets S of the full set of features $N = \{1,2, \ldots, n\}$, excluding the feature i for which you want to compute the **SHAP value**. Each subset represents a different combination of features present in the model.

For each subset S of features, calculate the contribution of adding feature i to the subset. This is done by comparing the model's prediction with feature i included versus excluded:
Contribution:

$$Contribution(S, i) = f(S \cup \{i\}) - f(S)$$

where $f(S)$ is the model prediction for subset S and $f(S \cup \{i\})$ is the prediction when i is added to S.

The SHAP value for feature i is the weighted average of its marginal contributions across all possible subsets:

$$\phi_i = \sum_{S \subseteq N\{i\}} \frac{S!\,(n - |S| - 1)!}{n!} \times (Contribution(S, i))$$

Here, $|S|!$ is the factorial of the number of features in subset S, $n - |S| - 1$is the factorial of the number of features not in S excluding i, and $n!$ is the factorial of the total number of features. This formula ensures each subset S is weighted according to the number of ways it can be formed.

The final prediction is explained as the sum of individual feature contributions (Shapley values): $f(x) = \sum_i SHAP(i)$

Applications of SHAP in Healthcare AI

Disease Risk Prediction: SHAP can elucidate which clinical factors contribute most significantly to AI-predicted risks of diseases, helping clinicians understand and prioritize interventions.

Treatment Outcome Analysis: It can analyze the impact of different variables on treatment outcomes, offering insights into why certain treatments may be more effective for specific patient groups.

Patient Readmission Prediction: SHAP can reveal the key factors leading to patient readmissions, enabling healthcare providers to address these issues proactively.

Diagnostic Imaging: In AI-driven diagnostic imaging, SHAP explanations can highlight the features in medical images (like X-rays or MRIs) that lead to specific diagnostic conclusions, aiding radiologists in validating AI findings.

Personalized Medicine: By understanding how different patient characteristics influence AI model predictions, SHAP can support personalized treatment plans, ensuring that they are tailored to the individual needs and risks of each patient.

MARKET DRIVERS FUELING AI IN HEALTHCARE

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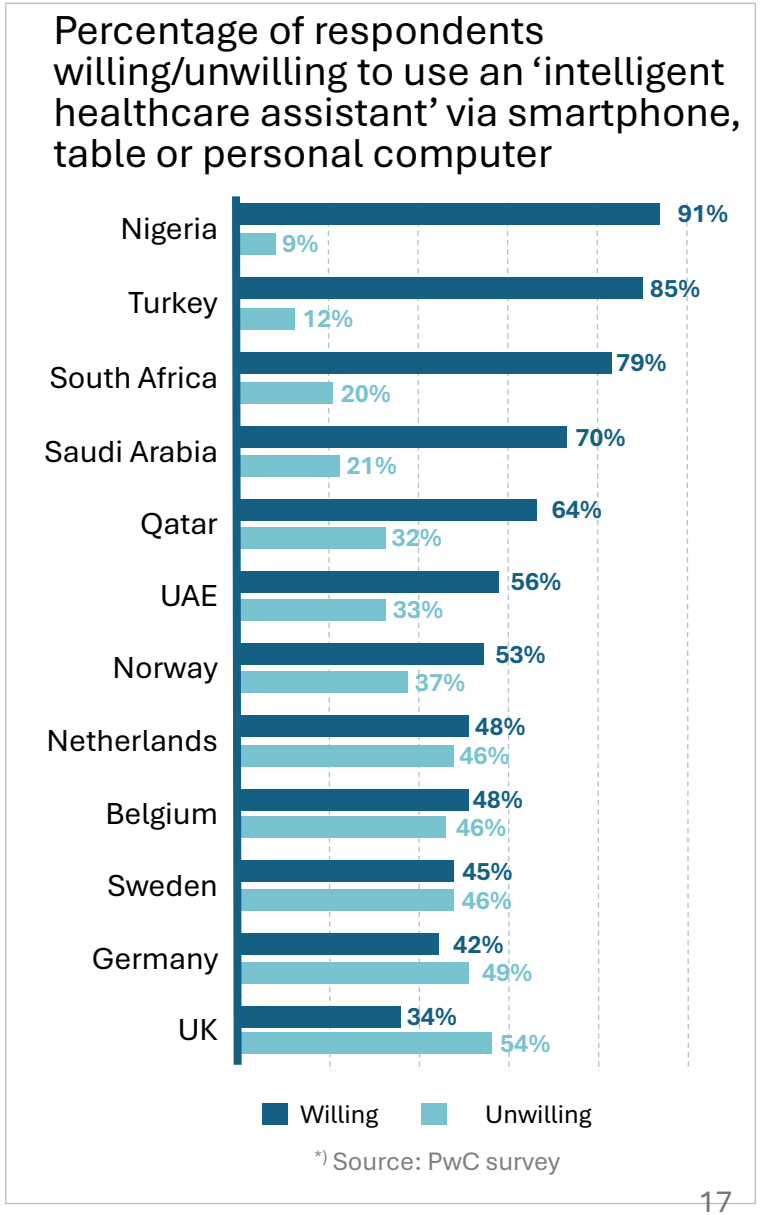

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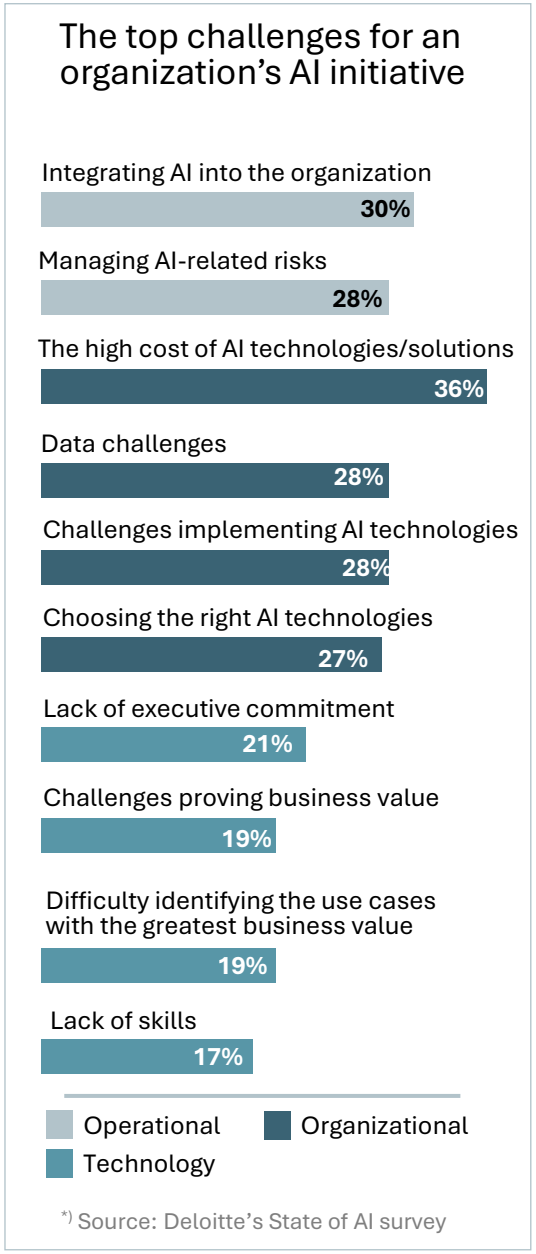

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