White Paper

Gemini's Technology Solutions

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General solutions to healthcare challenges exist now. Many of the AI-based healthcare approaches simply automate 19th century diagnostics of common diseases. Most of the AI-based approaches to therapeutics involve identifying and selecting off-the-shelf therapies to treat common diseases. Overall, these approaches involve applying AI to automate the existing medicine paradigm.

For about twenty-five years, since the discovery of the human genome, there has been a new level of insight into the source of human disease. About ninety percent of disease has a genomic origin, with many diseases caused by a genetic anomaly. Personalized medicine is the novel field that seeks to generate insight on the deeper causes of diseases from their genetic and proteomic origins. When a set of genes are damaged or mutated, they produce dysfunctional proteins. These malformed proteins operate in the machinery of cells and present as disease. Identification of the precise combination of genetic mutations reveals the exact source of each individual's disease manifestation. Consequently, this is the first step in identifying therapeutic solutions to the unique genetic malformations.

The personalized medicine revolution lies not only in identifying the correct mutated genes and the dysfunctional or mis-shaped proteins but also in finding with great particularity the unique therapy for each individual disease. Cancer is the paradigm for this model of personalized, or precision, medicine, but there are numerous other fields that trace cardiac, neurological, immunological, hereditary and genetic diseases.

Yet, in order to maximize the potential of the personalized medicine revolution, it is necessary to develop tools that provide insight into precision diagnostics and therapeutics. So far, bioinformatics has applied genetic testing, biomarker testing and imaging data to identify genetic diseases. But none of these excellent technologies enable a complete picture of the problem. Without a clear diagnostic picture – on a molecular and cellular scale – it is not possible to identify precise therapeutic solutions to treat a disease.

Most physicians are familiar with chatbots and their potential for making simple symptom-based diagnoses, which is like automating a 19th century approach to the practice of medicine. The GenAI revolution in healthcare is active and disruptive, since it promises to merge computer modeling with genomics, but incomplete. But most of the practice of medicine is still fragmented and piecemeal. There is a great need to integrate disparate technologies, including AI and new medical technologies in order to automate, customize and unify medical services with a high-quality patient-centered emphasis.

Gemini's core *intelligent digital healthcare solutions* comprise a set of integrated technology applications. We provide an AI-powered toolkit of technology resources in a vertical platform that enable physicians to solve health problems. The SaaS tools include:

(a) digital twins [DTs] modeling,

(b) personal health assistants [PHAs] (autonomous agents or co-pilots),

(c) patient relationship management [PRM] and

(d) patient data security [PDS].

These technologies collectively provide customized patient analyses and services. Gemini supplies a set of unified tools in a vertical SaaS platform for optimizing personalized medicine.

DTs are biological models that are enabled by AI technologies. As AI is rapidly developing, DTs are positioned to be the indispensable element in the physician's and

medical researcher's arsenal. The convergence of AI with personalized medicine is embodied in medical DTs.

DTs for Diagnostics: The patient's blood, lab, genetic and imaging diagnostics test results and IoT device data are analyzed by a (internist) physician by using our toolkit. The physician uses our SaaS and cloud-based DT modeling system in order to diagnose the patient's illness. The system also supplies a prognosis of the disease outcome potentialities. Once the illness is diagnosed, the physician uses our DT modeling system in order to identify personalized therapeutics solution options.

DTs for Therapeutics: In order to identify and optimize targeted therapies, the physician develops DT simulations to optimize cures or disease management in order to identify the best, most personalized, treatment course. The system also provides probabilities assessments of different treatment options. In some cases, there are gaps in data that need to be identified in order to solve patient disease diagnoses and therapeutics, which incomplete information the system endeavors to fill by requesting more information, such as running more tests so as to gain a more complete picture of the problem. AI (generative AI, general AI, deep learning and machine learning), cloud-based databases and software apps are integrated into Gemini's intelligent digital health platform.

Personal Health Assistants: The physician uses the PHA to assist her DT modeling analysis of the patient's condition. In addition, the PHA works with the doctor to manage the disease progress by updating information and modulating medicines. PHAs also work with PRM.

Patient Relationship Management: The physician applies PRM services to track patients throughout the diagnostic and therapeutic processes. Once the physician provides a therapeutic option, the patient is tracked by the DT model. The doctor applies the cloud-based PRM software in order to track updated patient data. The PRM works with the PHA.

Patient Data Security: With PDS, patient data are carefully managed with patient permissions at various phases of the process. Patient data are encrypted for security and privacy.

Partnership Referral Services: Referrals to partners will occur in (a) computational modeling services; (b) pharmacy referral services; (c) specialist physician services; (d) genomic and biomarker testing partners and; (e) biotech and pharma company referral services. Gemini receives a referral fee for each.

Digital Twins

The history of digital twins began with NASA in the 1960s in order to develop computer simulations of devices that could be computationally tested before activated in space. Today, DTs are mainly applied to electronic and industrial products. Ansys (Synopsys) develops DTs for industrial devices and components in order to computationally test and simulate object mechanics and functions. Nvidia also applies its GPU-based modeling to DTs for industrial object simulation. Cadence and Synopsys construct software products for application to electronic data automation applied to semiconductor design and operational testing.

A variety of startups are developing DTs software for application to various industries, from industrial and semiconductor design to healthcare systems. These include Twin Health (DTs for chronic disease management), Q Bio (radiological diagnostic DTs) and Unlearn.ai (DTs for drug trials). However, none of these are focused on Gemini's areas of DTs for personalized diagnostics and therapeutics.

In some ways, Gemini applies several converging technologies, including computing modeling (DTs) for molecular, cellular, organ, tissue and systems simulations. These technologies apply to personalized medicine to identify precise genomic variations for each individual patient that pinpoint the source of disease.

AI, including generative AI (GenAI), deep learning and machine learning are applied to bioinformatics and DTs as well. AI is particularly useful for identifying patterns in big healthcare data sets, for learning about the behaviors of specific individuals and for predicting behaviors from past data analyses.

About 30% – rapidly increasing – of the world's data are healthcare related with text documentation, imaging and video medical applications. These vast data sets feed Large Language Models ("LLMs"). While the healthcare diagnostics field is becoming increasingly crowded, particularly with the advent of LLMs and GenAI systems, these diagnostics approaches are focused on the macro level of general disease identification. For the most part, these systems are not focused on *personalized medicine* ("PM"), which develops a precise data analysis of each individual's genome and genetic dysfunctions and may require intensive computational resources. PM will dramatically increase healthcare data generation as data are collected and tuned to each individual.

Gemini's Medical Digital Twins Modeling System

DT modeling for personalized medicine involves simulating biological molecular, cellular, organ, tissue and systems structures and functions. The advantages of DT simulations include animating molecular and cellular interactions, identifying precise genetic mutations and their functional proteomics manifestations, developing customized biochemical or proteomic compounds to treat unique genetic diseases, identifying and testing therapeutic options, identifying drug side effects and interactions, identifying disease prognosis and predicting therapeutic effectiveness.

One of the advantages of digital twins applied to biomolecular models is that it enables the production of simulations to test therapy options before implementing these in the patient. The DTs enable experimentation of therapeutics in order to interrogate the data and to perform a trial-and-error process to eliminate less useful options. It is possible, with enough diagnostic precision, for DTs to design a customized therapy for a particular patient condition. Initially, we will use Rosetta and open-source modeling software.

In addition to being useful for biochemical solution discovery, DTs are useful for tracking the therapy options in patients. Over time, the patient supplies updated tests to ascertain the efficacy of treatment options, which are then updated and optimized in the DT model in order to present supplemental treatment options.

While DTs for precision diagnostics is an invaluable component of the Gemini toolkit, the application of DTs to therapeutics is a crucial element of our system. One cannot develop a precise treatment without having the benefit of precise insight of the

diagnostic source of a disease, but the development of unique custom therapies to individualized biomedical challenges is the holy grail of personalized medicine. Gemini's tools are uniquely suited to develop and test solutions to these complex biomedical problems.

Overall, DTs involve the interaction of AI and bioinformatics for application to personalized medicine in order to develop precise diagnostics and optimized therapeutics for disease management.

The present system of computer modeling is applied to medicine by categorizing different levels in the system architecture of medical digital twins.

Personal Health Assistants

The PHAs are AI driven autonomous software agents designed for interaction with physicians and patients. The PHAs operate like a software-based personal assistant to enable collection of patient data and general research information, to assist in analysis of healthcare data and to interact with, develop and optimize DTs for diagnostics and therapeutics. The PHAs are cloud-based SaaS software that operates like a smart general health aide. Many ventures have developed autonomous agents that may be useful for us.

- PHAs – intelligent agents – are powered by generative AI and specialized medical LLMs that are trained in GPU clusters; PHAs apply natural language processing (NLP), generative adversarial networks (GANs) and translation software; Gemini tailors foundation models with inference methods
- PHAs are applied to *Digital Twins modeling* as critical tool for physicians and researchers
  - PHAs used by physicians for diagnostics and therapeutics modeling
  - PHAs used by medical researchers for therapeutics modeling
  - PHAs used by physician assistants to track and manage patient activities
- PHAs as tools to *automate functions* for physicians and researchers
  - PHAs solve problems and generate solutions in DT modeling
  - PHAs work with physicians to manage DTs for diagnostic solutions
  - PHAs work with physicians and researchers to apply DTs for selection, discovery, design and testing of drugs and therapies
  - PHAs *personalize* patient processes (e.g., assist with health data records management)
  - PHAs act as physician and researcher co-pilots
  - PHAs track partnership referrals
- PHAs work with Patient Relationship Management (PRM) and Patient Data Security (PDS)
- Gemini's combination and integration of PHAs, DTs and PRM optimizes personalized medicine

Patient Relationship Management

Customer relationship management (CRM) software is a major industry organized on the principle that customer support can be automated.

Patients are often confused about the healthcare journey. When they get sick patients typically go to a doctor for a consult, the doctor assesses the patient's conditions and may order tests. When the patient needs to see a specialist, the journey continues. In the case of complex diseases, the journey becomes a labyrinth. In the majority of cases, the quest for a diagnosis is daunting enough. But the application of a complex therapeutic regime is particularly problematic for patients. How are they supposed to get the correct medicines and continue to manage their disease(s)?

PRM is intended to fill in the gaps of the medical system by integrating our apps to work with patients and doctors to manage doctor visits, medical testing appointments, pharmaceutical requests and patient tracking. PRM is a sort of after-doctor automation service that fills this critical need.

- The patient journey is a labyrinth of confusing, *ad hoc*, disaggregated doctor and testing contacts
- Ordering tests is hard; tracking treatments is harder
- Gemini's solution harnesses PRM to integrate various patient functions and physician contacts
- The integrated PRM in 4 categories: Analytical, Patient Management, Collaborative & Operational
  - **Analytical A**: *Patient Data Insights*: Automate electronic health record data capture, interpretation; simple diagnostic analysis and therapy recommendations (PHAs)
  - **Analytical B**: *DT Modeling*: Complex diagnostics, prognostics, therapeutics (PHAs)
  - **Patient Management**: Patient tracking, patient-doctor communications, doctor appointment scheduling, med test and imaging scheduling, medicine/device tracking, treatment feedback, physicians identify and manage personalized therapies, request and manage pharmaceutical prescriptions, patient education, ensure data security and patient permissions (PHAs, PDS)
  - **Collaboration**: Internist-specialist communications, track partnership referral network (specialists, researchers & pharma), insurance claims, drug clinical trials (PHAs)
  - **Operational**: Doctor office admin, doctor-nurse communications, office staff scheduling
- PRM services are powered by PHAs (GenAI and NLP)

Patient Data Security

Patient privacy is an important element of the healthcare system. HIPAA requires specific communications constraints in order to promote patient privacy. Patients are required to provide permission to enable their information to be private at various junctions in the medical discovery and treatment process.

PDS configures a cloud-based SaaS system that provides encryption for all patient data and patient communications. While HIPAA is about three decades old, founded at

a time when fax machines were in their prime, in some ways HIPAA is obsolete. Nevertheless, the impulse to maintain patient privacy is important.

One of the challenges of PDS is to enable patient privacy, on the one hand, and to allow general data to be used for medical studies, on the other. Patients are educated about privacy and security in order to allow them to make decisions about release of their fine-grained and course-grained medical information.

Partnership Referral Services

Partnerships with various specialists will be an important component of Gemini. These PRS referrals occur in several categories. The partnership referral services represent system outputs. We aim to receive a modest referral fee for some referrals.

Specialist physician referrals: Once physicians (especially internists) identify a patient diagnosis, they may require a referral to a specialist that we can facilitate.

Biotech and pharma referrals: In some cases, physicians may require direct referrals to biotech companies or pharma companies for solutions to complex patient diseases and drug clinical trials

Pharmacy referrals: Refer physicians to pharmacies, particularly for specialized medicines.

Genomic and biomarker testing: Apply genomic and biomarker testing by working with partners.

Computational modeling: Physicians and researchers will require supplemental supercomputer modeling (and data storage) services from our data center partners.

Gemini ties together all of these software applications (and services) into a unified whole in its SaaS platform. The integrated software tools embodied in Gemini's system enables physicians and researchers to provide novel personalized diagnostics and therapeutics in order to optimize medical care. Taken together, these tools simplify and democratize the healthcare system to enable physicians to identify and solve complex medical challenges.

Gemini aims to be the first point of departure for individual healthcare. Initially, the patient will begin with an internist or general practitioner (GP). The GP will work with the digital twins modeling program to diagnose the patient's illness. However, in some cases, the GP will need to provide a referral to one of a number of specialists. In one mode, the Gemini system will quickly identify a disease and request to move directly to a specialist referral. In any event, Gemini's toolkit of DT modeling, PHA's, PRM, PRS and patient security supplies the software services for disease diagnosis and therapeutics solutions.