Advancing Precision Healthcare for Veterans through HPC systems, and large-scale
Artificial Intelligence/Machine Learning (AI/ML)
The Department of Veterans Affairs (VA), Million Veteran Program (MVP)
And Department of Energy (DOE)
Request for Concept Ideas

Purpose and Overview

The Department of Veteran Affairs (VA) Office of Research and Development, the Million Veteran Program (MVP) and the Department of Energy (DOE) are requesting concept ideas to address clinical care gaps where high-performance computing (HPC), artificial intelligence (AI), and machine learning (ML) can be implemented to improve medical knowledge and apply to care at the VA. Investigators should identify focused problems that will utilize HPC and AI/ML computing resources to advance precision medicine and public health through analysis of medical records and genomic data. The primary goal of these clinical concept ideas is to create new tools and technologies for predicting disease outcomes by applying advanced computing and AI/ML to VA and to MVP genetic data, where applicable. (*Note: use of genetic data is not required; projects may include only VA health data*). By combining statistical and mechanistic models and fully utilizing the DOE's high performing computers we will enhance our understanding of disease prediction, prevention, and intervention – ultimately transforming health care for Veterans and the general population.

Background

The VA oversees the largest healthcare system in the U.S. and houses the richest health records and genomic data repository in MVP. Similarly, the DOE deploys the world's most powerful high-performance computing systems and oversees the nation's most advanced computational infrastructure for solving diverse scientific and engineering problems. The VA and MVP have partnered with DOE to advance the health and wellbeing of Veterans.

In 2016, the two agencies signed an interagency agreement and established a partnership called MVP-CHAMPION (Computational Health Analytics for Medical Precision to Improve Outcomes Now) to advance the frontiers of precision medicine and high-performance computation. By using DOE computers, secure data infrastructure and AI/ML tools and leveraging the expertise at DOE National Laboratories, the VA and MVP began to expand research methods that will help improve their understanding of issues important to Veteran's health.

To provide a computing environment that is accessible to both VA and DOE researchers for conducting research and analyzing VA and MVP data, a partnership was formed with the DOE's Oak Ridge National Laboratory (ORNL). They established a secure computing enclave for the VA called the Knowledge and Discovery Infrastructure (KDI), which leveraged their existing computing resources and AI/ML machinery. In 2018, ORNL launched one of the world's most powerful scientific supercomputers – SUMMIT. SUMMIT has a peak performance of 200,000 trillion calculations per second; with this remarkable computing power we can analyze the most challenging disease conditions and improve clinical practice while transforming medical science.

Data at ORNL is highly secured through both physical and cyber security controls. Copies of VA electronic medical records for all VA users, including MVP participants, are housed within the

KDI. Medical records are updated nightly. A copy of genotype data from 650,000 MVP participants also resides in the system. Each approved applicant and research team will have access to the VA computing enclave at ORNL and DOE expert data scientists from several DOE National Laboratories. In addition, investigators can submit requests for accessing SUMMIT and other supercomputing facilities.

Currently, three pilot projects employing AI/ML are nearing completion in the VA enclave at ORNL. These projects are focused on using VA longitudinal electronic health records (EHR) data linked to GWAS data to improve prediction of critical outcomes in suicide, cardiovascular disease, and prostate cancer disease progression to enable personalized prevention and treatment. These exemplar projects have created new genetics and modeling workflows, baseline models, and template analyses. In 2020, VA and DOE also partnered on several analyses related to COVID-19. In addition, a Genome-wide-Phenome-wide Association Analysis (gwPheWAS) of MVP data is being conducted on SUMMIT.

AI/ML tools – the simulation of human intelligence processes using machines/computers for problem solving – have already been used to influence clinical decisions and recommendations in healthcare. Disease risk assessment has continued to present a real challenge for clinicians. One important benefit of AI/ML is the creation of algorithms to more accurately and reliably predict disease outcomes from massive datasets.

Priority Areas

Researchers should identify concepts in a priority disease area that are relevant to Veterans' health. The concept idea should address a clinical gap where the sophistication of high-performance computation and AI/ML resources could benefit the VA in its mission to advance precision medicine.

Examples of types of methods and applications:

- Predictive outcomes modeling
- Risk modeling
- Population health
- Chronic disease management
- Precision medicine

Eligibility and Evaluation Criteria

Eligibility

- Proposed concept ideas should seek to advance the long-term goals of the VA, (e.g., identification of biomarkers, development of more effective clinical decision support and management tools, and creation of novel predictive disease risk models) to enhance the overall well-being and health of Veterans and require the use of a high-performance and AI/ML computational resources. Concept ideas should explain how knowledge gained from the proposed idea could be translated into clinical practice. Further, the conduct of the proposed analyses should demonstrate a requirement for high-performance computing resources available at DOE.
- The applicant (proposed VA PI) must have a 5/8ths VA appointment.

- Research will be performed within the secure VA-DOE enclave within the ORNL system or supercomputing facilities, and applicants must complete all required training and sign rules of behavior.
    - Researchers will have access to data, computing resources, and analytical tools within the secure ORNL system or super computers.
- Researchers will be partnering with DOE data scientists to meet their goals. Researchers whose concepts are approved will be matched with appropriate DOE data scientists to develop a full proposal and project plan. Although not required, proposals may suggest/include DOE scientist partners, where there are existing collaborations.
- Proposals resulting from selected concept ideas will be funded for a 2-year term, with well-defined project milestones, objectives, and key results will be tracked on a quarterly basis.
- Concept ideas based on clinical discoveries are highly encouraged, as is identifying a VHA clinical partner as part of the project team.
- Concept ideas should highlight potential for future clinical application.
- Applicants may not request access to MVP biospecimens or re-contact of MVP participants as part of the proposal.

Review criteria include

- Standard criteria (significance, innovation, approach, and investigative team)
- Concept ideas involving transdisciplinary, team-based coordination and collaboration will be prioritized
- Concept ideas that promise to enhance collaborations between HPC and AI/ML outcomes and basic/ translational scientists will be prioritized

Application Instructions

- Provide a summary of the concept idea addressing the topics below (5 pages maximum, excluding bio sketches and literature cited) using the template provided
    - Abstract- summary of the concept idea
    - Specific Aims - concisely state the gap in clinical care and the potential gain by employing HPC and AI/ML tools and the specific aim(s) to be achieved
    - Research Strategy – background, significance, innovation
    - Study population and data source (s) – description of data needed
    - Impact and implications of the proposed concept idea (including relevance to Veterans/VHA health care)
    - Literature Cited
    - List of key personnel involved and bio sketches

Expectations/Outcomes

- The proposed concept should be a clear research idea that is both clinically relevant and capable of being translated into clinical practice and could be used by clinicians to deliver better care and improve health outcomes for U.S. Veterans and the general population.

Evaluation

- The concept ideas will be reviewed by a joint VA-DOE panel, and the top-rated concepts will be approved to move forward to partner with DOE data scientists to develop a full proposal and a detailed project plan.
- Each concept idea will be evaluated for the significance and relevance of the proposed concept and related gain for Veterans' healthcare, appropriateness and need for the use of HPC and AI/ML for addressing the clinically relevant problem, and qualifications of the research team.
- Selection of concept ideas will be highly competitive and up to 6 concepts will be approved to move forward and develop full proposals.
- Decisions on concept ideas are final and may not be appealed.

Timeline

The deadline to submit concept ideas is December 15, 2021. Please submit concept ideas and questions to MVPLOI@va.gov. Notifications of approval of concept ideas will be communicated after the review process to each applicant via e-mail. The concept awards will be announced by January 15, 2022.

A webinar will be scheduled in November to describe data and computing resources available. Please stay tuned for announcement of the date and time.