DePaul University – Rosalind Franklin University of Medicine & Science
AI in Biomedical Discovery and Healthcare
2024 Grant Recipients

Title: Self-Operating System for Circulatory Management of Sepsis, Severe Sepsis, and Septic Shock

PI: Depaul: Mohammad Umer Huzaifa (CDM)

RFUMS: Raul Gazmuri

Award: $66,675

Sepsis, severe sepsis, and septic shock represent the progression of a severe systemic inflammatory response to an infectious process associated with hemodynamic abnormalities that may impair oxygen delivery to tissues and oxygen utilization by cells causing varying degrees of organ dysfunction. Critical to the successful management of sepsis and its more severe manifestations, is the rapid establishment of an environment of sustained circulatory stability and adequate regional organ blood flow while the infectious process is treated. However, the optimal delivery of these interventions for hours and even days is clinically challenging and resource intense without the ability to continuously adjust the interventions to specific targets exposing patients to the risk of excessive or deficient resuscitative fluid administration and to the risk of vasopressor and/or inotropic drug overuse leading to increased morbidity and mortality.

The current project is designed to develop an automatic system for the hemodynamic management of sepsis, severe sepsis, and septic shock using overlapping closed-loop systems and interlocked controllers to optimize the delivery of fluids, vasopressors, and inotropic drugs to uninterruptedly maintain an adequate systemic and regional organ blood flow until the systemic inflammatory response resolves. The system will be tested in a swine model of septic shock.

Title: SmokeSense: Advancing Wrist-Worn Devices with AI for Real-Time Smoking Insights

PI: DePaul: Mahdi Pedram (CDM)

RFUMS: Nancy Jao

Award: $66,835

By incorporating cutting-edge artificial intelligence (AI) technologies, we aim to accurately develop an innovative, privacy-conscious, wrist-worn device (SmokeSense) to passively detect and track real-time cigarette smoking behaviors. Using precise sensors to distinguish specific hand-to-mouth motions and air-based chemical compounds, the AI-powered device will be engineered to identify and distinguish cigarette use from other confounding movements (e.g., eating, drinking) and smoking products (e.g., e-cigarettes, marijuana). The AI integration will also seek to enhance user awareness, providing instantaneous alerts or feedback upon detection of cigarette use. To refine the AI models, we will conduct a pilot study with individuals who regularly smoke cigarettes to test the sensitivity and specificity of machine learning algorithms, as well as feasibility and acceptability of the device. The long-term implication of the proposed research project is to develop improved just-in-time adaptive interventions (JITAI) for smoking cessation using sophisticated technology and artificial intelligence programming.

Title: Validation of Inhalation Therapy to Enhance Anti-Malarial Immune Response Using Machine Learning

PI: DePaul: Thiru Ramaraj (CDM)

RFUMS: Rahul Vijay

Award: $67,000

The mosquito-borne disease malaria caused by the parasite Plasmodium resulted in at least 200 million clinical cases and 627,000 deaths in 2020. The malaria disease is bi phasic and begins as an immunologically muted liver stage followed by the highly inflammatory blood stage of infection. The blood stage of infection is characterized by fever, chills, systemic hypoxia and more importantly hemolytic anemia resulting from the proliferation of parasites in the red blood cells (RBCs). Anti-Plasmodium immune response is characterized by temporally layered T cell-dependent germinal center (GC) B cell responses that culminate in the formation of plasma cells and memory B cells. Despite this seemingly well-orchestrated humoral immune response, naturally acquired immunity to malaria offers limited clinical protection and fails to mount sterilizing immunity; the reason(s) behind this seeming paradox remains to be fully investigated. In this grant we will employ both mouse models of malaria (Sp Aim 1) and machine learning approaches (Sp Aim 2) to deduce parallels and to define surrogate markers of immunopathology and protection and thus to predict prognosis.