

Aneurysm Prognosis Classifier (APC)

Tool to predict the complication risk of abdominal aortic aneurysms

PROJECT SUMMARY

Abdominal aortic aneurysm (AAA) is the 13th leading cause of death in westernized countries. If left untreated, aneurysm growth may lead to high-morbidity aortic rupture. Early endovascular repair is the goal for most AAA treatment tracking regimes, as it reduces overall costs of AAA intervention when compared to direct costs associated with AAA monitoring over a 4-year period. Currently, the only variables clinicians have available to quantify small AAA complication risk are maximum diameter and rate of AAA growth. There are only a small number of software packages that increase rupture risk estimation beyond simple diameter measurements which solely focus on biomechanical properties, do not include patient history (age, gender, BMI, etc.), AAA shape irregularities, or AAA progression over time, and have yet to show predictability in rupture.

Aneurysm Prognosis Classifier (APC) uses the latest advancements in machine learning to predict the complication risk of a small AAA. APC algorithm provides clinicians with an objective, predictive tool to guide surgical intervention decisions before symptoms appear. There are currently companies performing computational simulations reporting traditional wall stress metrics, but they have not demonstrated the ability to predict AAA outcomes consistently.

RESEARCHERS

APC is led by Timothy K. Chung, MD, Trevor Kickliter, Michel S. Makaroun, MD, and David A. Vorp, PhD.

AuguryDX

Neonatal circulating cell-free DNA diagnostics for silent disease progression

PROJECT SUMMARY

Complex human diseases and most cancers often remain undetected until they become incurable or challenging to treat. Early diagnosis is frequently impossible or dangerously invasive by current methods. Treating advanced chronic diseases and cancer consumes the majority of health expenditure. To solve these problems, AuguryDx provides a platform technology that can be used to develop non-invasive, disease specific, early tests for screening or diagnosis of a variety of diseases. The AuguryDx platform is currently being validated through proof-of-concept studies in women's health and infant diseases, with plans for developing oncology applications in the near future.

RESEARCHERS

AuguryDx is led by David N. Finegold, MD and David G. Peters, PhD.

CADidME

Coronary Artery Disease Intelligent Detection via Metabolomic Expression

PROJECT SUMMARY

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality and causes 1 in 3 deaths in the U.S. (a total of 800,000 annually). CVD has taken a disproportionate toll on many racial and ethnic groups that have higher rates of CVD and its risk factors, and CVD accounts for about one-third of the disparity in potential life-years lost between blacks and whites. A prominent example of a CVD risk factor that varies based on race and ethnicity is vulnerable atherosclerotic plaques, a major culprit for CVD events. However, patient- and subtype-specific CVD risk assessment is currently lacking from clinical practice. Thus, there is a great need for tools to detect, diagnose, and stratify patients that would allow doctors to provide tailored interventions to high-risk groups.

CADidME is a risk prediction tool that characterizes CVD events according to specific subpopulation characteristics, including metabolomic data. CADidME tools will enable precision CVD diagnosis and management to reduce adverse CVD events in patients. CADidME uses comprehensive metabolomics profiles to standardize and replace multiple biomarker screening tests to benefit consumers, clinicians, and healthcare insurance through simplification and cost-effectiveness.

RESEARCHERS

CADidME is led by Vanathi Gopalakrishnan, PhD and Steven E. Reis, MD.

Clinical Abbreviation Resolution Engine (CARE)

Deep learning algorithm to reduce abbreviation misinterpretation within clinical datasets

PROJECT SUMMARY

Word sense disambiguation is a fundamental problem, particularly in clinical natural language processing (NLP). High accuracy acronym and abbreviation disambiguation is important for all clinical NLP tasks, as 71% of identified abbreviations in clinical text could be ambiguous in their meanings. Clinical NLP can unlock critical patient case details from unstructured clinical texts, such as patients' health records. However, the downstream decisions relying on clinical NLP can be incorrectly applied, in both clinical and research settings, if word, abbreviation and acronym ambiguity is incorrectly interpreted.

Clinical Abbreviation Resolution Engine (CARE) with Deep Sequential Learning is a deep learning method that addresses word sense disambiguation to significantly improve text information extraction from electronic medical record sources of high value, such as admission notes, consults, and discharge summaries. CARE has the potential to improve clinical NLP from an 80% accuracy rate (where it has been stalled for years) to over 95% by addressing these key additional word tokens.

RESEARCHERS

CARE is led by Daqing He, PhD and the iRIS team (Rui Meng, Zhendong Wang and Sanqiang Zhao).

Fall Sentinel

Multi-drug interaction analysis for fall risk reduction at skilled nursing facilities

PROJECT SUMMARY

Falls are the leading cause of fatal and nonfatal injuries among adults aged 65 years or more. This finding and the aging of our nation suggests that national attention on the problem of falls will continue to increase. Tools that can help reduce falls are badly needed in the skilled nursing facility setting, where 45-64% of the patients experience a fall each year. The mean incidence of falls is 1.7 falls per bed per year, 10-25% of which result in fracture or laceration. The market for skilled nursing facility fall prevention tools includes approximately 15,700 facilities that provide care for roughly 1.4 million residents. Treatment of falls in the nursing home is estimated to cost about \$5 billion per year and can result in further litigation risks.

Fall Sentinel is an automated risk monitoring system that applies a validated patient level prediction model to determine patient fall risk based on medication administration and Minimum Dataset data.

Fall Sentinel technology functions by processing a stream of electronic clinical data to provide highly patient-specific and clinically actionable alerts to clinicians when residents transition to a state of unacceptably high risk for experiencing a fall while exposed to a potential drug interaction or other fall-associated medication weak spot.

RESEARCHERS

Fall Sentinel is led by Richard D. Boyce, PhD, Eric Chou, and Katrina M. Romagnoli, PhD.

MEDivate

Solution to improve medication outcomes through consumer engagement during transitions of care

PROJECT SUMMARY

Preventable medication errors cost an unsustainable ~21 billion dollars annually. Consequently, healthcare spending has shifted from a fee-based model to one focused on value and cost savings. Payers rate institutions, pharmacies, and providers use quality metrics to justify payment, some of which are based on patient medication experiences. These groups are spending millions of dollars annually to prevent medication use problems through medication reconciliation tasks and education in order to improve their ratings, retain patients, and build efficiency. Patient engagement is a key aspect to achieving high quality, affordable care. The uptake of health-focused personal technology is exploding, but few products target medication outcomes, an estimated more than \$161 million market.

MEDivate is a simple-to-use, patient-centered smartphone application that empowers patients and providers to achieve great medication outcomes. Current market alternatives/barriers are costly, cumbersome, and often still paper-based. MEDivate's approach will be successful because it makes patient medication lists up-to-date, portable, and easy to share. Current medications are added directly to the app from EHRs or by the patient, and are always accessible. Patients trigger easy sharing of their personal medication history with their healthcare providers at the point of care. This ensures accuracy to reduce medication errors and ... ▼

RESEARCHERS

MEDivate is led by James Coons, PharmD and Phil E. Empey, PharmD, PhD.

MEDivate (continued)

Solution to improve medication outcomes through consumer engagement during transitions of care

saves time to improve transitions of care. MEDivate is also a personal medication coach. It reminds patients to take their meds and intelligently links key facts/educational videos on-demand from pharmacist experts.

RESEARCHERS

MEDivate is led by James Coons, PharmD and Phil E. Empey, PharmD, PhD.

OncoBioelectrx

Personalized implantable neuroengineered device for cancer treatment

PROJECT SUMMARY

Despite the use of targeted therapies, lung cancer remains a significant problem with a 5-year survival rate of 18%, and 25% of the annual cancer deaths. Inflammation is a critical component of lung tumor progression, and maintaining immune homeostasis in lung cancer patients is critical to:

1. Decrease inflammation and enhance the therapeutic effects of chemotherapy;
2. Reduce anti-inflammatory co-therapy that causes severe side effects; and
3. Reduce tumor-promoting myeloid cells and macrophages that promote tumor growth and drug resistance.

OncoBioelectrx is a drug-free, implantable immunotherapy neuromodulation device designed to stimulate anti-inflammatory pathways to achieve inflammatory homeostasis that can simultaneously repress inflammation and boost antitumor immunity.

RESEARCHERS

OncoBioelectrx is led by Chris J. Bettinger, PhD, Gary Fedder, PhD, Lee Fisher, PhD, Charles C. Horn, PhD, Xiao Chuan Ong, PhD and Gutian Xiao, PhD.

PI (PathImage) Predictor

Computational model that combines pathology and imaging data for breast cancer treatment

PROJECT SUMMARY

Each year over 246,660 women are diagnosed with breast cancer in the U.S., with 80% classified as estrogen-receptor-positive (ER+). Currently ~50% of ER+ breast cancer patients receive adjuvant chemotherapy, which has substantial side effects and toxicity, in addition to the primary treatment (most often surgery or radiation). Only 4% of the patients benefit from these therapies with no recurrence of breast cancer in the next 10 years. Currently, there are only limited risk prediction tools available in the clinic for diagnostic and prognostic testing, and to guide decision-making about whether to offer adjuvant chemotherapy to a patient.

PI predictor is a computational model that combines standard pathology parameters (a manual version is already available through Magee Womens Hospital) and radiological imaging features obtained via magnetic resonance imaging and digital mammography to replace the Oncotype DX assay. PI-predictor is a fast (<5 mins) and cost-effective method with no additional cost of using clinically readily available pathology and imaging data.

RESEARCHERS

PI-predictor is led by Rohit Bhargava, MD, David J. Dabbs, MD, and Shandong Wu, PhD.

Pressure Ulcer Monitoring Platform (PUMP)

Hospital acquired pressure ulcer prevention monitoring platform

PROJECT SUMMARY

Hospital acquired pressure ulcers (HAPUs) are areas of localized skin and soft tissue destruction caused by prolonged pressure in debilitated patients. The estimated PU prevalence is 3 million patients at a cost of \$3.6 billion per year. Several interventions and preventive measures are recommended to avoid hospital acquired pressure ulcers, including: patient repositioning, proper nutrition, pressure-relieving support surfaces, pneumatic mattresses, and skin care. Repositioning patients in bed is particularly a key preventative measure and a target of opportunity for low-cost innovative technology-based solutions.

Pressure Ulcer Monitoring Platform (PUMP) provides solutions for improving compliance with patient repositioning through nursing intervention solutions. It combines (1) a low-cost, but sophisticated wearable sensor that automatically detects when patients are repositioned and wirelessly records the event in the medical record, which is more suitable to patients with shorter lengths of stay, (2) a second sophisticated sensor device placed under the wheels of each hospital bed, which is more suitable for patients with longer lengths of stay or for those patients that are not suitable for a wearable device, and (3) an electronic alert system via mobile phone SMS to change nursing behavior and increase compliance. PUMP aims to minimize the operational and maintenance efforts by doctors and nurses, reduce obtrusiveness for patients, and to achieve the highest system reliability and minimal system cost.

RESEARCHERS

PUMP is led by Wenyan Jia, PhD, Danielle M. Minter, PhD, J. Peter Rubin, MD, Patsy Simon, RN, and Mingui Sun, PhD.

SPDx – SpIntellx

Improving accuracy and efficiency of cancer diagnosis through solid tumor spatial analysis

PROJECT SUMMARY

Cancer is a heterogeneous disease composed of various cancer cell, clonal sub populations and other types of cells that comprise the tumor microenvironment (TME). The heterogeneity within the TME is a major challenge for accurate diagnostic and prognostic tests, and the spatial context of the cancer cells and stromal cells, including the migratory immune cells within the TME, must be determined to properly diagnose the specific disease subtype and optimal treatment options.

Spatial Pathology Powers Cancer Diagnostics (SPDx) is a digital pathology software analytics tool that enhances the practice of pathology through the development of new machine learning software tools to computationally guide pathologists' decisions. Unlike competing digital pathology tools that only analyze digital whole slide images in the absence of spatial context and intra-tumor heterogeneity, SPDx provides objective and measurable spatial guidance for tissue structures and biomarker relationships that include measures of spatial heterogeneity within the patient's tissue slides. The incorporation of spatial heterogeneity measurement into pathological workflows enables precision medicine approaches to be incorporated into diagnostic and ... ▼

RESEARCHERS

SPDx has become a company called SpIntellx led by Michael J. Becich, MD, PhD, S. Chakra Chennubhotla, PhD Jeffrey L. Fine, MD, D. Lansing Taylor, PhD, and A. Burak Tosun, PhD.

SPDx – SpIntellx (continued)

Improving accuracy and efficiency of cancer diagnosis through solid tumor spatial analysis

prognostic activities, including prediction of tumor metastases and optimal therapeutic treatment planning. SPDx provides value through faster, quantitative, objective, and more accurate decisions for both current and next-generation digital pathology workflows.

RESEARCHERS

SPDx has become a company called SpIntellx led by Michael J. Becich, MD, PhD, S. Chakra Chennubhotla, PhD Jeffrey L. Fine, MD, D. Lansing Taylor, PhD, and A. Burak Tosun, PhD.

TDI – DioneX

More accurate cancer diagnostics from identifying tumor driver genetic mutations

PROJECT SUMMARY

Precision oncology aims to treat patients based on the genomic makeup of their individual tumor. However, current methods are limited in their approach and scope. For example, immunotherapy drugs are currently used as first line treatment for many solid tumors, including melanoma, without prior genetic testing. While around 30% of patients benefit from this approach, no solution exists to select better treatments for the large group of non-responders, leading to suboptimal outcomes and higher costs. To help address this problem, DioneX has developed algorithms that can estimate disease mechanisms of individual tumors and predict the most effective, personalized treatment for each patient.

The core technology of DioneX is TDI—Tumor Driver Identification—an engine that employs causal inference modeling and data mining integration of genomic and transcriptome characterizations of individual tumors. The algorithm estimates the causal relationships between gene alterations (M) and molecular phenotypes (P) within each individual tumor. Using Bayesian causality analysis theory, a patient-specific predictive model of the individual disease mechanism is constructed. This novel approach is designed to provide oncologists with data-driven decision support that improves diagnosis and selection of individualized, targeted cancer treatments.

RESEARCHERS

DioneX is led by Gregory Cooper, MD, PhD and Xinghua Lu, MD, PhD, MS.