15-688 Project Proposal:
Predicting Artificial Heart Implant Outcome

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The artificial heart, VAD (ventricular assist device), is an implantable electromechanical device used to partially replace the function of a heart. It is the last therapeutic treatment for people in end-stage heart failure. VADs were expected to extend patients lives for several years. However, many patients who received VADs died shortly after the implant[1]. In this project, we plan to mine previous VAD recipients' clinical records and outcomes, aiming to build machine learning models that can help physicians to predict the likely outcome of each implant.

We plan to use the INTERMACS dataset[2] for this project. This dataset includes 23,787 patients' clinical data relevant to mechanical circulatory support devices (VAD is one kind of such devices) from initial hospitalization through post-implant follow-up evaluations. We will elicit data of the patients who have received VAD implants and have died or explanted. Their pre-implant clinical conditions will be starting places for our feature engineering, and the time interval between their implant and death/explant will be our training labels.

Comparable previous works on VAD implant prognostics using INTERMACS data most often used linear regression or Bayesian models. The accuracy of one-year mortality predictions is about 83% [3] to 84.5%[4].

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[1]Reference: Benza, Raymond L., et al. "An evaluation of long-term survival from time of diagnosis in pulmonary arterial hypertension from the REVEAL Registry." Chest 142.2 (2012): 448-456.

[2]https://intermacs.uab.edu/

[3]Loghmanpour NA, Kanwar MK, Druzdzel MJ, Benza RL, Murali S, Antaki JF. A New Bayesian Network-Based Risk Stratification Model for Prediction of Short-term and Long-term LVAD Mortality. ASAIO journal (American Society for Artificial Internal Organs: 1992). 2015;61(3):313-323. doi:10.1097/MAT.0000000000000209.

[4]Kourou, Konstantina, et al. "Prediction of time dependent survival in HF patients after VAD implantation using pre-and post-operative data." Computers in biology and medicine 70 (2016): 99-105.