

## Deep Learning to Predict Postoperative Acute Kidney Injury

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**Background:** Rapid, preoperative identification of those patients at highest risk for medical complications is necessary to ensure that limited infrastructure and human resources are directed towards those most likely to benefit. Existing risk scores often lack specificity at the patient level, utilize the American Society of Anesthesiologists (ASA) physical status classification which requires a clinician to review the chart, or are focused on a broad array of outcomes and this inaccurate for specific outcomes. Recently machine learning has been used as a technique to make more focused risk scores that can be targeted at specific outcomes. In this abstract we describe the creation of a score to predict postoperative acute kidney injury (AKI) based on data that can be readily abstracted from the electronic medical record before surgery.

**Methods:** We use deep learning to create a fully automated score that predicts postoperative severe (AKIN stage 2, stage 3) Acute Kidney Injury (AKI), based solely on structured data available before the time of surgery. We use an embedding layer that transforms our categorical features (sex, type of surgery, self-reported ethnicity, etc.) to numerical ones as part of our deep learning model. Then, combined with the numerical feature we train a 4 layers (2 hidden) fully connected neural network to generate our prediction score. The total number of trainable parameters in our model is 68,864. Our model was trained on a total of 63411 unique patient admissions when out of those 5.29% suffered from AKI post-surgery. We use dropout to prevent over fitting and train our model with batch stochastic gradient descent. We've chosen our hyper-parameters (number of layers, dropout rate, etc.) using cross validation.

**Results:** We found that the deep learning model we use achieves an AUC of 0.939 [0.934-0.943], outperforming existing methods (e.g., koyner et al 2018<sup>1</sup>, AUC of 0.90 [0.90-0.90], ASA score, AUC 0.784 [0.779-0.789], Charlson comorbidity scores, AUC 0.77 [0.755-0.785]).

**Conclusions:** Our automated model can help predict acute kidney injury prior to surgery and changes in serum creatinine. Our model shows superior accuracy compared to existing methods and can potentially help clinicians make real-time decision that can help prioritize the treatment of patients that are at higher risk for acute kidney injuries and allow more efficient allocation of resources.

### References:

1. Koyner JL, Carey KA, Edelson DP, et al. . The development of a machine learning inpatient acute kidney injury prediction model. *Crit Care Med* 2018; 46 (7): 1070–7.