L.A.C.E Project

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Overview

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What is L.A.C.E?

Identifies 'at risk' patients for readmission or death within a 30 day discharge

L = Length of Stay

  Includes admission and discharge

A = Acuity of Admission

  Admitted via Emergency Department

C = Comorbidities

  Weighted System based off of ICD 9 or 10

E = Emergency Department Visits

  Number of times a patient visits an emergency department 6 months

  prior to admission excluding the preceding visit

Comorbidity: CHF

Congestive Heart Failure (CHF)

~ 6 million Americans living with CHF

~ 100,000 people diagnosed yearly

~ 5% of UK Emergency admissions

```
# "428.0"  Congestive heart failure
# "428.1"  Left heart failure
# "428.2"  Systolic heart failure
# "428.3"  Diastolic heart failure
# "428.4"  Combined systolic and diastolic heart failure
# "428.9"  Heart failure, unspecified
```

~ 35% chance of death within 1st year after diagnosis

Comorbidity: Diabetes

Diabetes

~25 million Americans living with Diabetes

~1.5 to 5 million deaths, 2012 to 2015.

```
# "250.0" Diabetes mellitus without mention of complication
# "250.1" Diabetes with ketoacidosis
# "250.2" Diabetes with hyperosmolarity
# "250.3" Diabetes with other coma
# "250.4" Diabetes with renal manifestations
# "250.5" Diabetes with ophthalmic manifestations
# "250.6" Diabetes with neurological manifestations
# "250.7" Diabetes with peripheral circulatory disorders
# "250.8" Diabetes with other specified manifestations
# "250.9" Diabetes with unspecified complication
```

Global Economic Cost

~ $612 Billion

US Economic Cost

~ $245 Billion

Models

Linear Regression (glm)

- Built-in linear model
- https://stat.ethz.ch/R-manual/R-devel/library/stats/html/glm.html

Neural Net (nnet)

- Single-layer neural net
- https://cran.r-project.org/web/packages/nnet/index.html

Model: glm

```
lmModel <- glm(readmit30 ~ L + A + C + E +
               heart_failure_comorbidity +
               diabetes_comorbidity +
               Admit_source,
            data=trainSet)
```

```
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)               -0.0285044  0.0051127  -5.575 2.52e-08 ***
## L                          0.0154843  0.0008215  18.848  < 2e-16 ***
## A                          0.0071049  0.0013098   5.424 5.91e-08 ***
## C                          0.0002022  0.0016357   0.124   0.902
## E                         -0.0005556  0.0018779  -0.296   0.767
## heart_failure_comorbidity  0.0015283  0.0023526   0.650   0.516
## diabetes_comorbidity             NA         NA      NA       NA
## Admit_sourceEmergency Room       NA         NA      NA       NA
## Admit_sourceSNF           -0.0026170  0.0075680  -0.346   0.729
## Admit_sourceTransfer      -0.0005489  0.0046494  -0.118   0.906
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

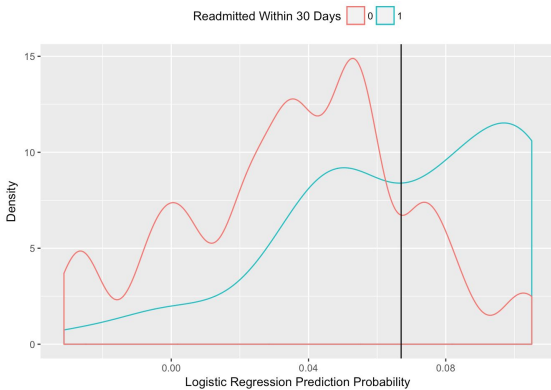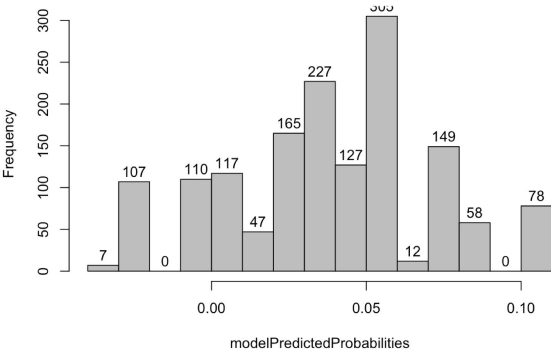# Model: nnet
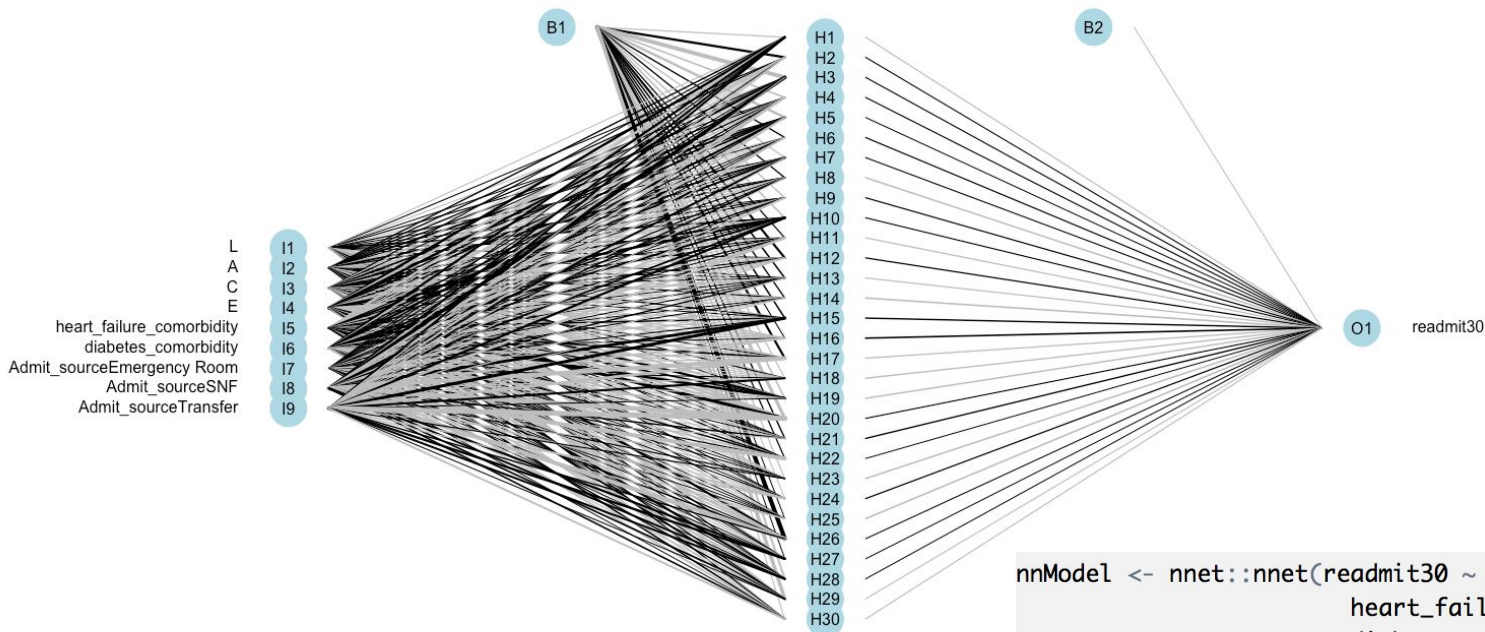

```
nnModel <- nnet::nnet(readmit30 ~ L + A + C + E +
                      heart_failure_comorbidity +
                      diabetes_comorbidity + Admit_source,
             data=trainSet,size=30,maxit=1000,linout = TRUE)
```
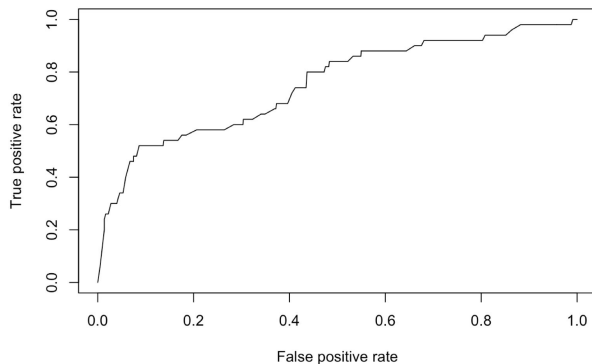
Results: glm

Histogram of modelPredictedProbabilities

	Predicted No Readmission	Predicted Readmission
No Readmission	1397	62
Readmission	34	16

Accuracy	0.9363817
AUC	0.7521385

Results: nnet

Histogram of modelPredictedProbabilities
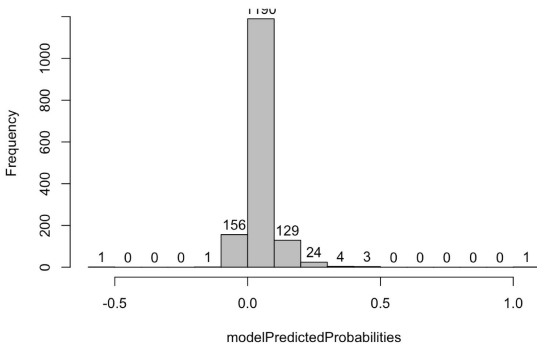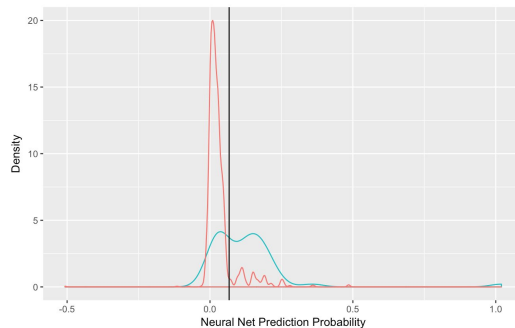
	Predicted No Readmission	Predicted Readmission
No Readmission	1453	6
Readmission	48	2
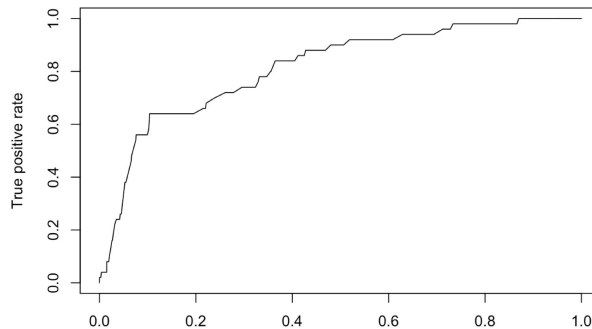
Accuracy	0.9642147
AUC	0.8150034

Discussion

	glm	nnet
Accuracy	0.9363817	0.9642147
AUC	0.7521385	0.8150034
Sensitivity (proportion of positives that are correctly identified)	0.09427609	0.1702128
Specificity (proportion of negatives that are correctly identified)	0.9818482	0.986374
Positive Predictive Value (probability that positive prediction is positive)	0.56	0.64
Negative Predictive Value (probability that negative prediction is negative)	0.9243986	0.8965517

Questions & Listening