ROC and Reclassification analysis in R - part 2

R Ísland meeting

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The category free NRI (continuous NRI)

- Statistics in Medince 2011 (online 2010)
- Extensions of net reclassification improvement calculations to measure usefulness of new biomarkers
- Michael J. Pencina, Ralph B. D Agostino Sr, and Ewout W. Steyerberg

$$NRI = \frac{(P(event|up) - P(event))P(up) + (P(event) - P(event|down))P}{P(event)(1 - P(event))}$$

- Notice the prospective defintion
- It can be interpreted as a measure of event rate increase among those who are reclassified upwards and event rate decrease among those who are reclassified downwards
- Applies to survival and case control data

The continuous NRI

- From PredictABEL
- reclassification(wcgs.s,11,pred1,pred2,c(0,0.1,0.2,1))
- NRI(Continuous) [95% CI]: 0.4081 [0.2892 - 0.527] ; p-value: 0

Survival data

```
cox1 <- cph(Surv(time169,chd69) ~ age0 + cholmmol + sbp0 +
cox2 <- cph(Surv(time169,chd69) ~ age0 + cholmmol + sbp0 +
lrtest(cox1,cox2)
```

```
##
## Model 1: Surv(time169, chd69) ~ age0 + cholmmol + sbp0 -
## Model 2: Surv(time169, chd69) ~ age0 + cholmmol + sbp0 -
##
## L.R. Chisq       d.f.          P
##  2.644e+01  1.000e+00  2.723e-07
```

The C statistic comparison (Harrell)

```
rcorrp.cens(1-predict(cox1,type="lp"),1-predict(cox2,type="
```

```
##                 Dxy                 S.D. x1 more concordant
##         -1.488e-02           3.480e-02           4.926e-01
## x2 more concordant                   n             missing
##          5.074e-01           3.141e+03           0.000e+00
##          uncensored    Relevant Pairs           Uncertain
##          2.560e+02           1.364e+06           8.499e+06
##               C X1                C X2              Dxy X1
##          7.237e-01           7.401e-01           4.474e-01
##             Dxy X2
##          4.802e-01
```

The C statistics (survC1)

```
mydata1<-cbind(wcgs.s$time169,wcgs.s$chd69,cox1$x)
mydata2<-cbind(wcgs.s$time169,wcgs.s$chd69,cox2$x)
sc1<-Est.Cval(mydata1,5*365.24)
sc2<-Est.Cval(mydata2,5*365.24)
names(sc1)
```

```
##  [1] "Dhat"      "rs"        "beta"      "beta.var"  "U
##  [6] "ft"        "cens.surv" "cens.psii" "distinct"  "wt
## [11] "nofit"
```

```
sc1$Dhat
```

```
## [1] 0.7281
```

```
sc2$Dhat
```

```
## [1] 0.7484
```

C statistics (timeROC)

```
troc1<-timeROC(wcgs.s$time169,wcgs.s$chd69,predict(cox1,typ
troc2<-timeROC(wcgs.s$time169,wcgs.s$chd69,predict(cox2,typ
troc1
```

```
## Time-dependent-Roc curve estimated using IPCW  (n=3141,
##           Cases Survivors Censored AUC (%)   se
## t=0           0      3141        0      NA   NA
## t=1826.2    139      2768      234   73.35 2.13
##
## Method used for estimating IPCW:marginal
##
## Total computation time : 22.54  secs.
```

```
troc2
```

```
## Time-dependent-Roc curve estimated using IPCW  (n=3141,
##           Cases Survivors Censored AUC (%)   se
## t=0           0      3141        0      NA   NA
```

Comparisons (timeROC)

```
compare(troc1,troc2)
```

```
## $p_values_AUC
##       t=0 t=1826.2
##        NA  0.01866
```

Pepe paper 2013

- Statistics in Medicine 2013
- Pepe MS
- Tests of significance of parameter, change in AUC, NRI, IDI all equivalent
- Makes no sense to test the same hypothesis many times
- Report AUC and change as descriptive statistics and focus on practical change in magnitude
- Show reclassification tables rather than the continuous NRI

Conclusion

- Is Jörgen Hilden right about these being good looking statistics with nothing underneath?
- Yes, because all the statistical signficance to test is for the parameter
- Don't dwell on the statistical significance of difference in AUC, NRI and IDI
- The additional statistics are still good descriptive statistics of model performance
- The AUC is a fundamental statistic to report and the inteplay between sensitivity and specificity
- Decision theory (papers by Vickers and Steyerberg)