

Jeffrey D. Blume
Vanderbilt University
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Examples of ROC sample size projections w/ R functions 'roc.ss1' & 'roc.ss2'

Example 1. What is the sample size needed to obtain a 95% CI of length 0.2 (MOE=0.1) on an AUC of 0.7 with 2:1 ratio of reference standard negative to positives.

Answer 1: Under the Bi-normal assumption you need 44 positives (and thus 88 negatives). Over all distributions, the maximum number of positives needed is 81 and the minimum number is 33. So the Bi-normal assumption is not too conservative.

```
> roc.ss1(p=0.7,len=0.2,k=2,p1=0.8,beta=0.2)
#####
##  Bounds on sample size projections: Single AUC = p(normal < abnormal)
##  Ratio of normals to abnormals, k , is 2 (usually k>=1)
##  Number of Readers = 1 ; Reader corr. = 0.3 ; Inflation factor = 1
##  Table indicates number of abnormals required
##
##  ESTIMATION   : AUC = 0.7 ; CI Length = 0.2 ; alpha = 0.05
##  -----
##  Bounds       : Max      = 81 ;   Min      = 33
##  Projections  : Bi-Nor   = 44 ;   Bi-Exp   = 43
##
##  HYP-TESTING  : AUC0 = 0.7 ; AUC1 = 0.8 ; beta = 0.2 ; alpha = 0.05
##  -----
##  Bounds       : Max      = 153 ;   Min      = 61
##  Projections  : Bi-Nor   = 85 ;   Bi-Exp   = 81
#####
```

The bottom sample size projection is for the hypothesis test with $H_0: \text{AUC} \leq 0.7$ and $H_1: \text{AUC} > 0.7$ with 80% power. Thus under the Bi-normal assumption you need at least 85 positive and 170 negatives (b/c $k=2$).

Example 2. The sample situations as in Example 1 but with 4 readers (all readers read all cases) and a correlation between reader AUCs of $\rho=0.4$.

```
> roc.ss1(p=0.7,len=0.2,k=2,p1=0.8,beta=0.2,reader=2,rho=0.4)
#####
##  Bounds on sample size projections: Single AUC = p(normal < abnormal)
##  Ratio of normals to abnormals, k , is 2 (usually k>=1)
##  Number of Readers = 2 ; Reader corr. = 0.4 ; Inflation factor = 0.7
##  Table indicates number of abnormals required
##
##  ESTIMATION   : AUC = 0.7 ; CI Length = 0.2 ; alpha = 0.05
##  -----
##  Bounds       : Max      = 57 ;   Min      = 23
##  Projections  : Bi-Nor   = 31 ;   Bi-Exp   = 31
##
```

```
## HYP-TESTING : AUC0 = 0.7 ; AUC1 = 0.8 ; beta = 0.2 ; alpha = 0.05
## -----
## Bounds      : Max      = 108 ; Min      = 43
## Projections : Bi-Nor   = 60 ; Bi-Exp   = 57
#####
```

Answer 2: Under the Bi-normal assumption you need 31 positives (and thus 62 negatives). Over all distributions, the maximum number of positives needed is 57 and the minimum number is 23. The bottom sample size projection is for the hypothesis test with $H_0: AUC \leq 0.7$ and $H_1: AUC > 0.7$ with 80% power with 4 readers and $\rho=0.4$. Thus under the Bi-normal assumption you need at least 60 positives and 120 negatives (b/c $k=2$).

The twosample ROC, 'roc.ss2' function works similarly.