R Code for Computing the Maximum Score Estimator

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January 25, 2017

In this article, we discuss the R code that computes the maximum score estimator proposed in C. Manski (1975) and C. F. Manski (1985). In the follwoing we consider the simulation scenario used in Table 2 of Patra, Seijo, and Sen (2015). We fix $\beta_0 = \frac{1}{\sqrt{d}}(1, \ldots, 1)^\top$ and assume that

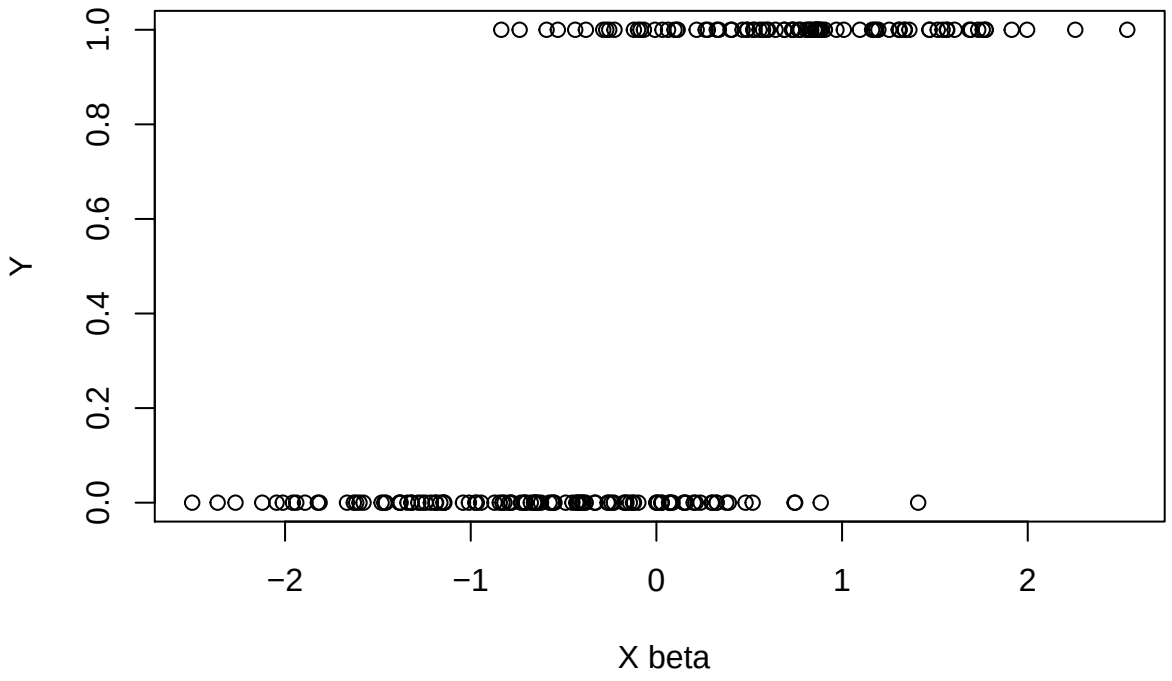
$$U|X \sim N\left(0, \frac{1}{(1+|X|^2)^2}\right), \quad X \sim \text{Uniform}([-1,1]^d), \quad \text{and} \quad Y = \mathbf{1}_{\beta_0^\top X + U \geq 0}.$$

For demonstration purposes, we fix $n = 200$ and $d = 3$. The following codes generate the sample and computes the maximum score estimator.

```
rm(list= ls())
source('MSE.R')
```

```
## Loading required package: slam
```

```
n<-200
d<-3
X <- matrix(runif(n*d, -1,1), n,d)
beta.0 <- rep(1,d)
sdx <- (1 +  rowSums(X^2))^(-1)
err <- rnorm(n,0,sdx)
ind <- X%*%beta.0
y <- as.vector((ind+err>0)*1)
plot(ind,y, xlab= paste(" X", expression(beta)), ylab="Y")
```




```
ans <- MSE(X,y)
cat(" The MSE for this data set is:  ")
```

```r
print(ans$beta.hat, digits=3)
print(paste("It took ", format(ans$time,  digits=2), " secs to compute the above MSE"))
```

```
## Rcplex: num variables=203 num constraints=200
##  The MSE for this data set is:  [1] 0.717 0.377 0.586
## [1] "It took  0.46 secs  secs to compute the above MSE"
```

The above code requires a valid CPLEX installation and the R pakcage Rcplex to run. Our codes are based on the excact MIP algorithm propsoed in Florios and Skouras (2008). The required R file "MSE.R" can be downloaded here. The codes to implement the smoothed botstarp procedure in Patra, Seijo, and Sen (2015) is forthcoming.

I would like to thank Florios Kostas for his helpful discussions and comments. See here for a MATLAB version of the code.

References

Florios, Kostas, and Spyros Skouras. 2008. "Exact Computation of Max Weighted Score Estimators." *Journal of Econometrics* 146 (1). Elsevier: 86–91.

Manski, C. 1975. "Maximum Score Estimation of the Stochastic Utility Model of Choice." *J. Econometrics* 3: 205–28.

Manski, Charles F. 1985. "Semiparametric Analysis of Discrete Response. Asymptotic Properties of the Maximum Score Estimator." *J. Econometrics* 27 (3): 313–33. doi:10.1016/0304-4076(85)90009-0.

Patra, Rohit K., Emilio Seijo, and Bodhisattva Sen. 2015. "A Consistent Bootstrap Procedure for the Maximum Score Estimator." *J. Econometrics (Revision Resubmitted)*. http://arxiv.org/abs/1105.1976.