Computacional study

Marina Rosell i Pau Lozano

6/5/2020

Carreguem les dades generades pel codi de matlab

```
X <- read.csv("uo_nn_batch_49784363-54409254.csv", sep=';', row.names=NULL, header
= TRUE)
X <- X[,-9]
colnames(X) <- c('num_target', 'la', 'isd', 'niter', 'tex', 'tr_acc', 'te_acc', 'L*
')

X$num_target <- as.numeric(X$num_target)
X[1:18,]
```

```
##    num_target la isd niter    tex tr_acc te_acc       L*
## 1           1  0   1     4 0.1037  100.0  100.0 6.28e-09
## 2           1  0   3     4 0.0604  100.0  100.0 1.80e-10
## 3           1  0   7  1001 0.1111   78.0   70.4 5.00e-05
## 4           1  1   1   134 1.4203  100.0  100.0 3.47e+00
## 5           1  1   3    21 1.7346  100.0  100.0 3.47e+00
## 6           1  1   7   409 0.3439   94.0   95.2 7.45e-01
## 7           1 10   1    61 1.0335  100.0  100.0 1.43e+01
## 8           1 10   3    30 0.4431  100.0  100.0 1.43e+01
## 9           1 10   7  1001 0.1745   58.4   48.4      Inf
## 10          2  0   1  1001 5.5946  100.0  100.0 9.85e-04
## 11          2  0   3    92 0.7569  100.0   94.4 2.02e-07
## 12          2  0   7    87 0.0802   94.0   93.2 3.13e-10
## 13          2  1   1   118 1.9388  100.0   99.6 7.02e+00
## 14          2  1   3    26 0.3681  100.0   99.6 7.02e+00
## 15          2  1   7   542 0.1822   94.4   93.2 9.43e-01
## 16          2 10   1   112 2.2540   96.8   95.2 2.15e+01
## 17          2 10   3    29 0.4785   96.8   95.2 2.15e+01
## 18          2 10   7  1001 0.2726   55.2   50.8      Inf
```

Separem les dades segons la λ per obtenir representacions gràfiques

```
la0 <- X[X$la == 0,]
col<- rep("black",nrow(la0))
col[la0$isd == 1] <- "red"
col[la0$isd == 3] <- "dodgerblue"
col[la0$isd == 7] <- "green3"
la1 <- X[X$la == 1,]
la10 <- X[X$la == 10,]
```

1. Convergence of the algorithms

Convergència global - Número d'iteracions

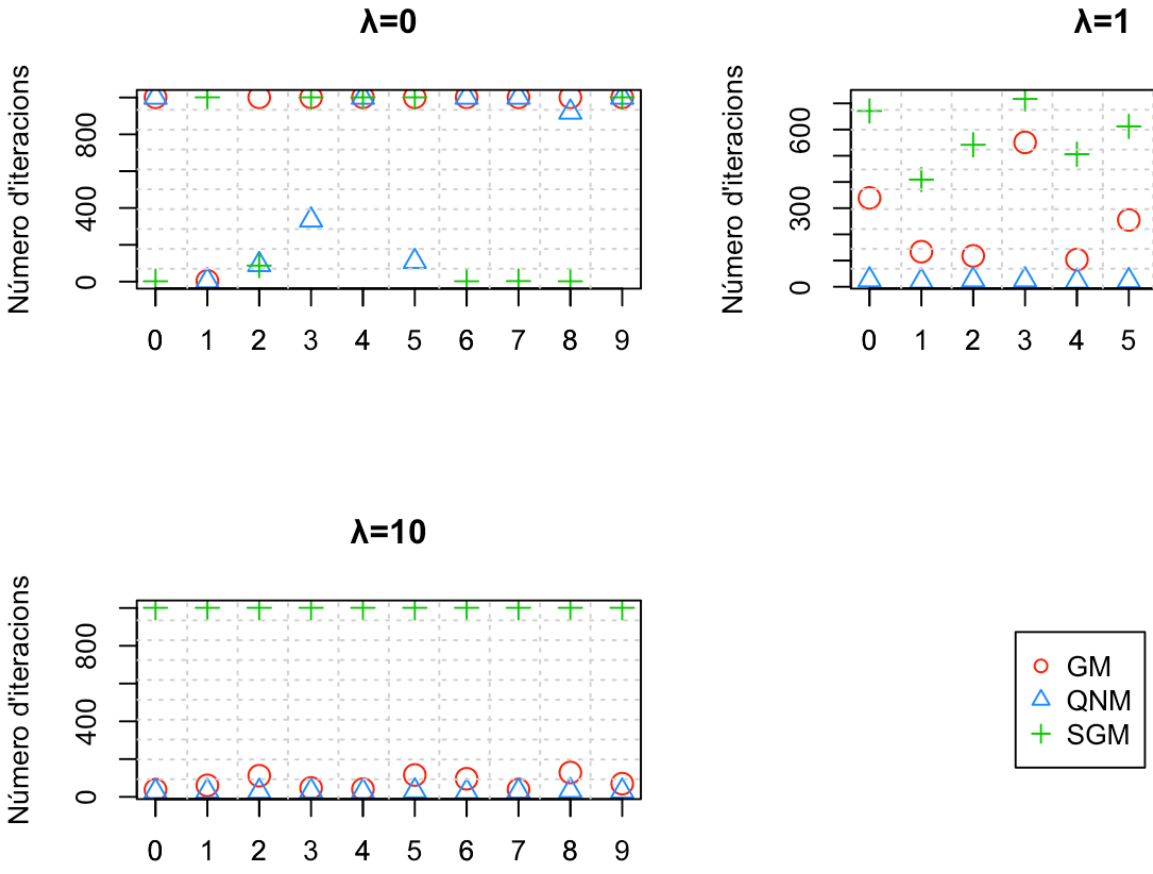
```
par(mfrow=c(2,2))

plot(la0$num_target ,la0$niter, col = col, cex=c(1.7,1.3,1.3), ylab="Número d'itera
cions", xlab="", main="λ=0", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

plot(la1$num_target ,la1$niter, col = col, cex=c(1.7,1.3,1.3), ylab="Número d'itera
cions", xlab="", main="λ=1", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

plot(la10$num_target ,la10$niter, col = col, cex=c(1.7,1.3,1.3), ylab="Número d'ite
racions", xlab="", main="λ=10", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

legend("right", legend = c("GM","QNM","SGM"), col = c("red","dodgerblue", "green3")
, cex=1, pch=c(1,2,3),xpd=NA, inset=c(-1,0))
```



Funció objectiu L*

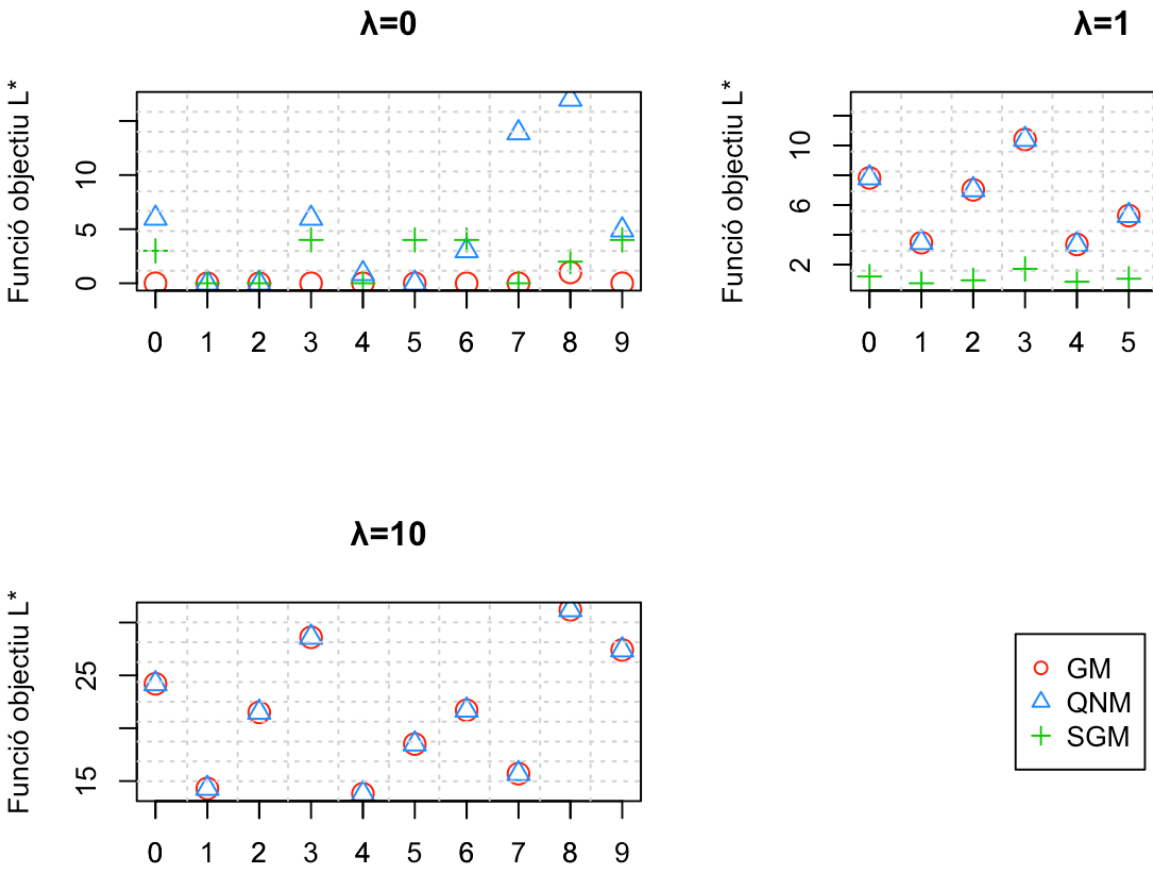
```
par(mfrow=c(2,2))

plot(la0$num_target ,la0$`L*`, col = col, cex=c(1.7,1.3,1.3), ylab="Funció objectiu
L*", xlab="", main="λ=0", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

plot(la1$num_target ,la1$`L*`, col = col, cex=c(1.7,1.3,1.3), ylab="Funció objectiu
L*", xlab="", main="λ=1", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

plot(la10$num_target ,la10$`L*`, col = col, cex=c(1.7,1.3,1.3), ylab="Funció object
iu L*", xlab="", main="λ=10", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

legend("right", legend = c("GM","QNM","SGM"), col = c("red","dodgerblue", "green3")
, cex=1, pch=c(1,2,3),xpd=NA, inset=c(-1,0))
```



Convergència local - Temps d'execució

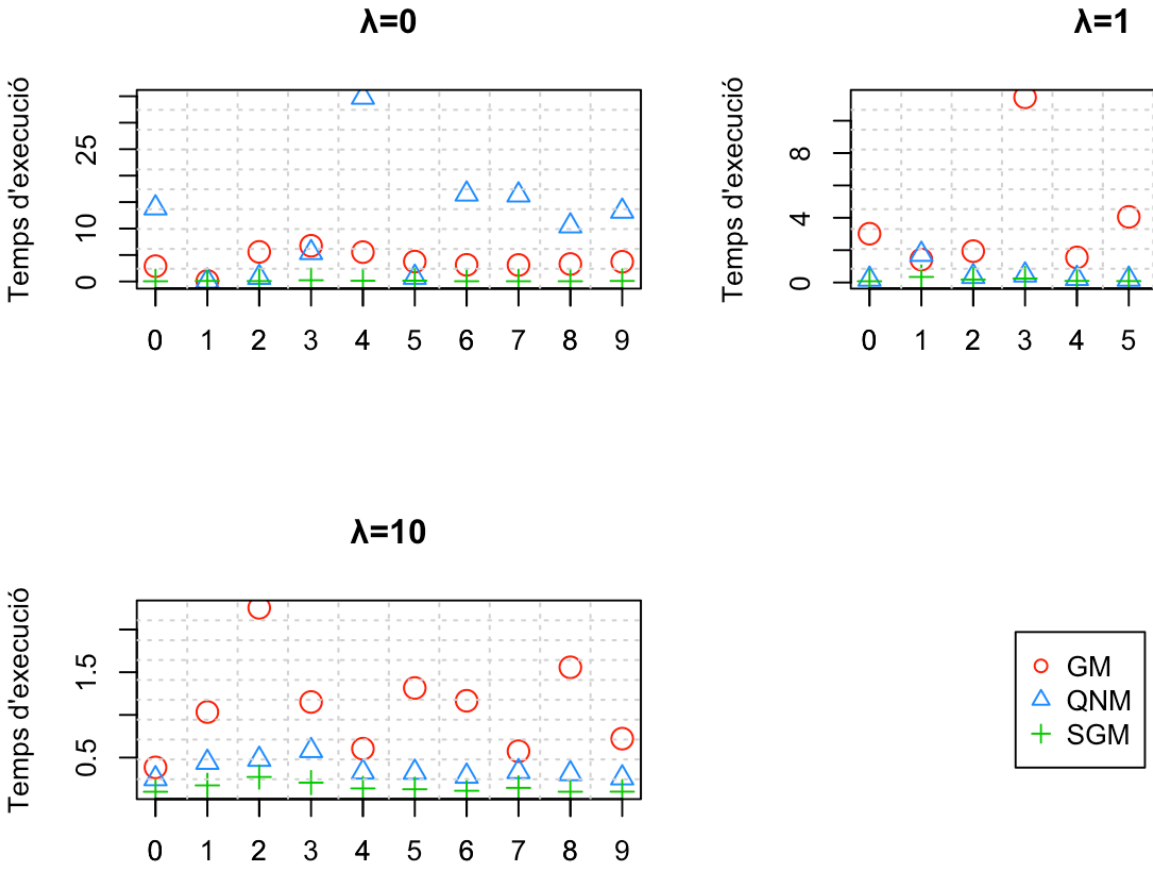
```
par(mfrow=c(2,2))

plot(la0$num_target ,la0$tex, col = col, cex=c(1.7,1.3,1.3), ylab="Temps d'execució
", xlab="", main="λ=0", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

plot(la1$num_target ,la1$tex, col = col, cex=c(1.7,1.3,1.3), ylab="Temps d'execució
", xlab="", main="λ=1", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

plot(la10$num_target ,la10$tex, col = col, cex=c(1.7,1.3,1.3), ylab="Temps d'execuc
ió", xlab="", main="λ=10", pch=c(1,2,3))
axis(side=1, labels=NULL, at=0:9)
grid(10)

legend("right", legend = c("GM","QNM","SGM"), col = c("red","dodgerblue", "green3")
, cex=1, pch=c(1,2,3),xpd=NA, inset=c(-1,0))
```



Comparativa detallada del temps d'execució de Quasi Newton amb λ=1 i λ=10

```
la1qn <- la1[la1$isd==3,]
la10qn <- la10[la10$isd==3,]
la1qn$tex
```

```
##  [1] 1.7346 0.3681 0.4578 0.2433 0.1985 0.2176 0.1902 0.2178 0.2003 0.1991
```

```
la10qn$tex
```

```
##  [1] 0.4431 0.4785 0.5811 0.3294 0.3270 0.2805 0.3350 0.3107 0.2613 0.2513
```

2. Recognition accuracy

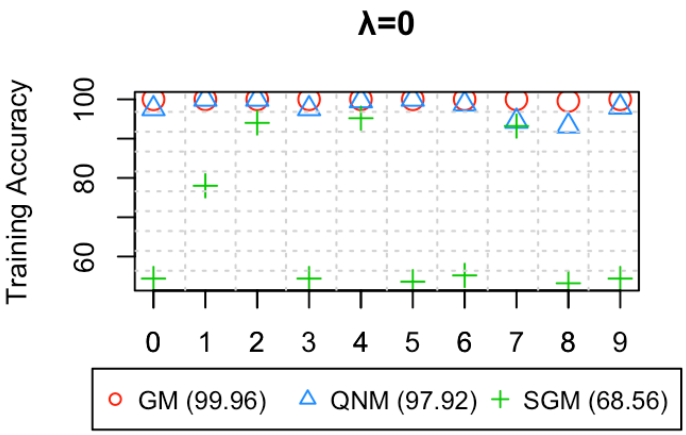
Training accuracy

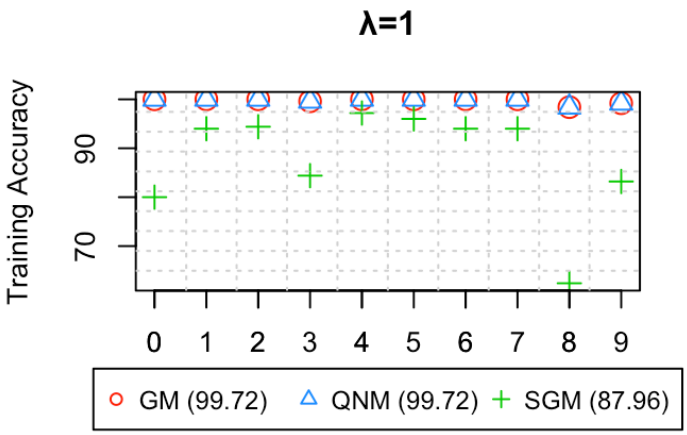
```
leg_tr <- function(la)
{
  axis(side=1, labels=NULL, at=0:9)
  grid(10)
  leg_gm <- paste("GM (", mean(la[la$isd==1,]$tr_acc),")", sep="")
  leg_qnm <- paste("QNM (",mean(la[la0$isd==3,]$tr_acc),")", sep="")
  leg_sgm <- paste("SGM (",mean(la[la0$isd==7,]$tr_acc),")", sep="")
  legend("bottom", legend = c(leg_gm,leg_qnm,leg_sgm), col = c("red","dodgerblue",
"green3"), cex=.9, pch=c(1,2,3),xpd=NA, inset=c(0,-0.7), horiz=TRUE)
}
```

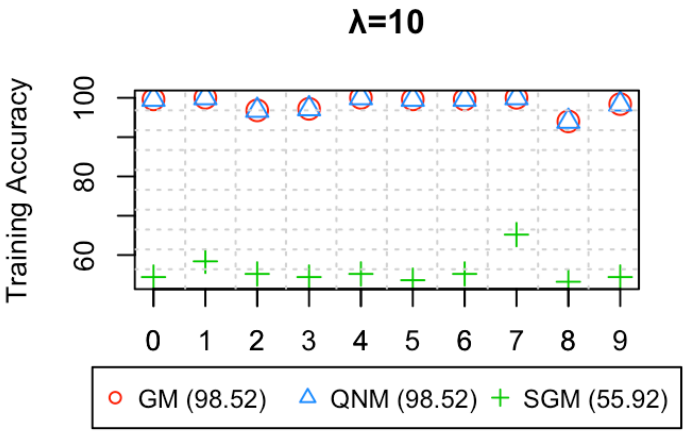
```
par(mfrow=c(2,2))
plot(la0$num_target ,la0$tr_acc, col = col, cex=c(1.7,1.3,1.3), ylab="Training Accu
racy", xlab="", main="λ=0", pch=c(1,2,3))
leg_tr(la0)

plot(la1$num_target ,la1$tr_acc, col = col, cex=c(1.7,1.3,1.3), ylab="Training Accu
racy", xlab="", main="λ=1", pch=c(1,2,3))
leg_tr(la1)

plot(la10$num_target ,la10$tr_acc, col = col, cex=c(1.7,1.3,1.3), ylab="Training Ac
curacy", xlab="", main="λ=10", pch=c(1,2,3))
leg_tr(la10)
```







Testing accuracy

```
leg_te <- function(la)
{
  axis(side=1, labels=NULL, at=0:9)
  grid(10)
  leg_gm <- paste("GM (", mean(la[la$isd==1,]$te_acc),")", sep="")
  leg_qnm <- paste("QNM (",mean(la[la0$isd==3,]$te_acc),")", sep="")
  leg_sgm <- paste("SGM (",mean(la[la0$isd==7,]$te_acc),")", sep="")
  legend("bottom", legend = c(leg_gm,leg_qnm,leg_sgm), col = c("red","dodgerblue",
"green3"), cex=.9, pch=c(1,2,3),xpd=NA, inset=c(0,-0.7), horiz=TRUE)
}
```

```
par(mfrow=c(2,2))

plot(la0$num_target ,la0$te_acc, col = col, cex=c(1.7,1.3,1.3), ylab="Testing Accur
acy", xlab="", main="λ=0", pch=c(1,2,3))
leg_te(la0)

plot(la1$num_target ,la1$te_acc, col = col, cex=c(1.7,1.3,1.3), ylab="Testing Accur
acy", xlab="", main="λ=1", pch=c(1,2,3))
leg_te(la1)

plot(la10$num_target ,la10$te_acc, col = col, cex=c(1.7,1.3,1.3), ylab="Testing Acc
uracy", xlab="", main="λ=10", pch=c(1,2,3))
leg_te(la10)
```