result_soc

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CRPS Calculation

```
loss_all <- read.csv(here::here("us_soc/soc_loss.csv"))

us_soc <- read.csv(here::here("us_soc/soc.csv"))

long <- us_soc$long
lat <- us_soc$lat
y <- us_soc$soc

library(verification)
```

```
## Loading required package: boot

## Loading required package: CircStats

## Loading required package: MASS

## Loading required package: dtw

## Loading required package: proxy

##
## Attaching package: 'proxy'

## The following object is masked from 'package:spam':
##
##     as.matrix

## The following objects are masked from 'package:stats':
##
##     as.dist, dist

## The following object is masked from 'package:base':
##
##     as.matrix

## Loaded dtw v1.23-1. See ?dtw for help, citation("dtw") for use in publication.
```

```r
calculate_dist_between <- function(x){
  return( mean(spDists(matrix(x, ncol = 1)))  )
}

calculate_dist_true <- function(x, true_x){

  return( abs(x-true_x) )

}

crps <- function(prediction_matrix, true_value){
  print("Calculating between-sample distance . . .")
  between_sample <- apply(prediction_matrix, 1, calculate_dist_between)
  print("Calculating absolute error . . .")

  sample_residual <- rowMeans(apply(prediction_matrix, 2, calculate_dist_true, true_x = true_value))

  res <- 0.5 * between_sample - sample_residual
  return(-res)
}

pred_dnn <- as.matrix(read.csv("D:/77/Reasearch/temp/dnn_pred_soc.csv"))
pred_dk <- as.matrix(read.csv("D:/77/Reasearch/temp/dk_pred_soc.csv"))
pred_ck <- as.matrix(read.csv("D:/77/Reasearch/temp/ck_pred_soc.csv"))
pred_inla <- as.matrix(read.csv("D:/77/Reasearch/temp/inla_pred_soc.csv"))



crps_dnn_all <- crps(pred_dnn,y)
```

```
## [1] "Calculating between-sample distance . . ."
## [1] "Calculating absolute error . . ."
```

```r
crps_dk_all <- crps(pred_dk,y)
```

```
## [1] "Calculating between-sample distance . . ."
## [1] "Calculating absolute error . . ."
```

```r
crps_ck_all <- crps(pred_ck,y)
```

```
## [1] "Calculating between-sample distance . . ."
## [1] "Calculating absolute error . . ."
```

```r
crps_inla_all <- crps(pred_inla,y)
```

```
## [1] "Calculating between-sample distance . . ."
## [1] "Calculating absolute error . . ."
```

```
# write.csv(crps_dnn_all,"D:/77/Reasearch/temp/crps_dnn_soc.csv",row.names = FALSE)
# write.csv(crps_dk_all,"D:/77/Reasearch/temp/crps_dk_soc.csv",row.names = FALSE)
# write.csv(crps_ck_all,"D:/77/Reasearch/temp/crps_ck_soc.csv",row.names = FALSE)
# write.csv(crps_inla_all,"D:/77/Reasearch/temp/crps_inla_soc.csv",row.names = FALSE)

crps_dnn_all <- as.matrix(read.csv("D:/77/Reasearch/temp/crps_dnn_soc.csv"))
crps_dk_all <- as.matrix(read.csv("D:/77/Reasearch/temp/crps_dk_soc.csv"))
crps_ck_all <- as.matrix(read.csv("D:/77/Reasearch/temp/crps_ck_soc.csv"))
crps_inla_all <- as.matrix(read.csv("D:/77/Reasearch/temp/crps_inla_soc.csv"))

print(paste("CRPS of DNN is: ", mean(crps_dnn_all)))
```

```
## [1] "CRPS of DNN is:  8.89972476246077"
```

```
print(paste("CRPS of DK is: ", mean(crps_dk_all)))
```

```
## [1] "CRPS of DK is:  6.79958419679281"
```

```
print(paste("CRPS of CK is: ", mean(crps_ck_all)))
```

```
## [1] "CRPS of CK is:  6.25095862596831"
```

```
print(paste("CRPS of INLA is: ", mean(crps_inla_all)))
```

```
## [1] "CRPS of INLA is:  8.14079085400016"
```

Interval Score Calculation

```
int_score <- function(l,u,true_x,alpha = 0.05){
  out_1 <- u-l
  out_2 <- 2/alpha * (l-true_x) * ifelse(true_x < l, 1, 0)
  out_3 <- 2/alpha * (true_x-u) * ifelse(true_x > u, 1, 0)
  return(out_1 + out_2 + out_3)
}

all_interval_score <- function(prediction_sample, alpha = 0.05, true_x){
  num_all <- length(true_x)
 pb <- txtProgressBar(min = 0,      # Minimum value of the progress bar
                     max = num_all, # Maximum value of the progress bar
                     style = 3,    # Progress bar style (also available style = 1 and style = 2)
                     width = 50,   # Progress bar width. Defaults to getOption("width")
                     char = "=")   # Character used to create the bar


  all_score <- rep(NA, length(true_x))
 for (int_score_idx in 1:length(true_x)) {
   setTxtProgressBar(pb, int_score_idx)
    l <- quantile(prediction_sample[int_score_idx,], alpha/2)
```

```
    u <- quantile(prediction_sample[int_score_idx,], 1-alpha/2)
    all_score[int_score_idx] <- int_score(l = l, u = u, true_x = true_x[int_score_idx], alpha = alpha)
  }
 return(all_score)
}

int_score_dnn <- all_interval_score(prediction_sample = pred_dnn, true_x = y)
```

| |

```
int_score_dk <- all_interval_score(prediction_sample = pred_dk, true_x = y)
```

| |

```
int_score_ck <- all_interval_score(prediction_sample = pred_ck, true_x = y)
```

| |

```
int_score_inla <- all_interval_score(prediction_sample = pred_inla, true_x = y)
```

| |

```
# write.csv(int_score_dnn,"D:/77/Reasearch/temp/int_dnn_soc.csv",row.names = FALSE)
# write.csv(int_score_dk,"D:/77/Reasearch/temp/int_dk_soc.csv",row.names = FALSE)
# write.csv(int_score_ck,"D:/77/Reasearch/temp/int_ck_soc.csv",row.names = FALSE)
# write.csv(int_score_inla,"D:/77/Reasearch/temp/int_inla_soc.csv",row.names = FALSE)


print(paste("Interval Score of DNN is: ", mean(int_score_dnn)))
```

[1] "Interval Score of DNN is: 279.518527355934"

```
print(paste("Interval Score of DK is: ", mean(int_score_dk)))
```

[1] "Interval Score of DK is: 177.951566943419"

```
print(paste("Interval Score of CK is: ", mean(int_score_ck )))
```

[1] "Interval Score of CK is: 171.406250906544"

```
print(paste("Interval Score of INLA is: ", mean(int_score_inla )))
```

[1] "Interval Score of INLA is: 224.670262467493"

```
icr_inla <- sum( y>apply(pred_inla, 1,quantile, 0.025) & y<apply(pred_inla, 1,quantile, 0.975) )/length
icr_dnn <- sum( y>apply(pred_dnn, 1,quantile, 0.025) & y<apply(pred_dnn, 1,quantile, 0.975) )/length(y)
icr_dk <- sum( y>apply(pred_dk, 1,quantile, 0.025) & y<apply(pred_dk, 1,quantile, 0.975) )/length(y)
icr_ck <- sum( y>apply(pred_ck, 1,quantile, 0.025) & y<apply(pred_ck, 1,quantile, 0.975) )/length(y)



score_tab <-
  rbind(

    apply(loss_all, 2, mean)
    ,
    apply(cbind(crps_inla_all,crps_dnn_all,crps_dk_all,crps_ck_all),2, mean)
    ,
    matrix(c(icr_inla, icr_dnn, icr_dk, icr_ck), nrow = 1)
    ,
    apply(cbind(int_score_inla,int_score_dnn,int_score_dk,int_score_ck),2, mean)
  )

rownames(score_tab) <- c("MSE", "Negative CRPS", "ICR", "Interval Score")
colnames(score_tab) <- c("INLA","Base DNN", "DK","CK")


#xtable::xtable(t(round(score_tab,2)),aline = "c")

knitr::kable(round(score_tab,3))
```

	INLA	Base DNN	DK	CK
MSE	137.510	151.115	119.852	124.226
Negative CRPS	8.141	8.900	6.800	6.251
ICR	0.302	0.196	0.375	0.391
Interval Score	224.670	279.519	177.952	171.406