GBU Plots-recommendations

Contents

1 Setup the enviroment

```r
setwd("basicUtils/")
devtools::document()
devtools::install()
devtools::load_all()
setwd("..")
```

```r
library(gridExtra)
library(cowplot)
library(grid)
library(basicUtils)
library(tidyverse)
library(ggthemes)
```

```r
to_knit = T
#levander blueSky greyGreen green purple grey red blueGrey
#yellow sparklingGreen orrange beige purple_smooth
l = getColors("blueGrey")
baseColor = l$baseColor
bgColor = l$darkColor
if (to_knit==T){
baseSize = 9
shape_size=2
annot_size =2
line_size=0.5
}else{
baseSize = 20
shape_size=5
annot_size=4
line_size=2
}
l$lightColor
```

```
FALSE [1] "#c2dfe3"
```

```r
highlightColor = l$highlightColor
baseShape = 7
highlightShape = 15
fontTheme = 'sans'
serror = function(x) sqrt(var(x,na.rm = T) / length(x))
```

2 Definition of necessary functions

2.1 Formalizing labels

```
update_model_names <- function(k1) {
  k1$model <- factor(k1$model)
  levels(k1$model)[levels(k1$model)=="svdbinary"]="SVD\n(implicit)"
  levels(k1$model)[levels(k1$model)=="svdtrinary"]="SVD\n(p-aware)"
  levels(k1$model)[levels(k1$model)=="svdtrinaryexplicit"]="SVD\n(explicit)"
  levels(k1$model)[levels(k1$model)=="explicit_SVD"]="SVD\n(explicit)"
  levels(k1$model)[levels(k1$model)=="cnn"]="CNN\n(implicit)"
  levels(k1$model)[levels(k1$model)=="lstm"]="LSTM"
  levels(k1$model)[levels(k1$model)=="svm"]="SVM"
  levels(k1$model)[levels(k1$model)=="xg"]="XGBoost"
  levels(k1$model)[levels(k1$model)=="trinary_SVD"]="SVD\n(p-aware)"
  levels(k1$model)[levels(k1$model)=="sahoo"]="HMM-CF\n(implicit)"
  levels(k1$model)[levels(k1$model)=="logit"]="Lgistic\nregression"
  levels(k1$model)[levels(k1$model)=="rf"]="Random\nforest"
  levels(k1$model)[levels(k1$model)=="hmm"]="HMM"
  levels(k1$model)[levels(k1$model)=="fb"]="Reputation\n(implicit)"
  return(k1)
}
```

2.2 Getting general percentage improvement

```
get_imprvement = function(d,algorithm){
  new_d = ((d$hmm - d[,algorithm])/d[,algorithm]) * 100
  return(new_d)
}
```

2.3 Estimating regression lines and getting confidence intervals

```
get_labels = function(r,level){ #regression labels
t = tibble()
avg = se = 1
for(model in unique(r$model)){
    r[r$model==model,] ->cur_r
    res = lm(avg ~ n,cur_r)
    from = confint(res, 'n', level = level)[1]
    to = confint(res, 'n', level = level)[2]
    intercept = res$coefficients[1]
    #position to print the conf-int
    yposition = ifelse(intercept > 1, 0.9 * intercept,
```

```
            ifelse(intercept > 0, -20 * intercept, 2 * intercept))#intercept
    t %>% bind_rows(tibble(from,to,model,yposition,avg,se)) -> t
}
return(t)
}
```

2.4 Generate a ranking performance plot

```
get_ranking_performance_plot = function() {
get_focal_imprvs = function(algorithm){
  new_d = get_imprvement(d,algorithm) %>% bind_cols(d %>% select(prc,fold))
  new_d %>% rename(improvement = algorithm) %>% mutate(model = algorithm) %>%
  group_by(model,prc) %>% summarise(avg=mean(improvement,na.rm = T),
                                      se = serror(improvement))-> new_d
    return(new_d)
  }
d = read.csv(paste("../../data/evaluation_results/ranking_performance.csv",
                   sep=""))
baselines = unique(d$algorithm)
baselines = baselines[baselines != 'hmm']
d %>% pivot_wider(names_from = algorithm, values_from=score)-> d
baselines %>% map_dfr(get_focal_imprvs) -> r
r %>%  update_model_names %>%  ggplot( aes(x = prc, y = avg,
                          ymin = (avg - 1.645 * se), ymax = (avg + 1.645 * se),
                      color = baseColor, fill = '1')) +
    geom_col(alpha=0.7,size=line_size)+
    facet_wrap(~model, ncol = 6, scales = "free_y") +
    geom_errorbar(width = 0.3) +
    scale_color_manual(values = c(baseColor), name = "Improvement over") +
    scale_fill_manual(values = c(baseColor), name = "Improvement over") +
    xlab("Ranked cohort (p)") +
    scale_x_continuous(breaks = c(0.5,1),labels =c('Bottom 50%', 'Top 50%')) +
    geom_hline(yintercept = 0, linetype = "dashed") +
    geom_vline(xintercept = 0.5, linetype = "dashed", alpha = 0.2) +
    ylab(" Performance lift (%)") +
    theme_minimal(base_size = baseSize) +
    theme(legend.position = "none")->p
  return(p)
}
```

2.5 Generate an AUC-n plot

```
get_auc_n_plot = function() {
  get_focal_imprvs = function(algorithm){
    new_d = get_imprvement(d,algorithm) %>% bind_cols(d %>% select(n,fold))
    new_d %>% rename(improvement = algorithm) %>% mutate(model = algorithm) %>%
    group_by(model,n) %>% summarise(avg=mean(improvement,na.rm = T),
                                    se = serror(improvement))-> new_d
    return(new_d)
  }
d = read.csv("../../data/evaluation_results/auc_single_assessment.csv")
baselines = unique(d$algorithm)
baselines = baselines[baselines != 'hmm']
d %>% pivot_wider(names_from = algorithm, values_from=score)-> d
baselines %>% map_dfr(get_focal_imprvs) -> r
get_labels(r,level=0.9) %>% update_model_names ->t
r %>% update_model_names %>%  ggplot(aes(x = n, y = avg,
                           ymin = (avg -1.645 * se), ymax = (avg + 1.645 * se),
                                          color = baseColor, shape = '1')) +
  geom_smooth(aes(fill = baseColor), method = 'lm', alpha = 0.2,size=line_size)+
  scale_color_manual(values = c(baseColor), name = "Improvement over") +
  scale_fill_manual(values = c(baseColor), name = "Improvement over") +
  scale_shape_manual(values = c(baseShape), name = "Improvement over") +
  xlab("") +
  geom_text(t, mapping = aes(x = 10, y =yposition,
          group = model,
          label = paste("Slope 90% CI: [", round(from, 2), ", ",
                        round(to, 2), "]", sep = ""),
          size = annot_size, color = baseColor),
          check_overlap = T,inherit.aes = FALSE, size=annot_size) +
  scale_x_continuous(breaks = c(1, 5,10, 15,20)) +
  facet_wrap(~model, ncol = 5,  scales = "free_y")+
  geom_hline(yintercept = 0, linetype = "dashed") +
  ylab("AUC Improvement (%)") +
  theme_minimal(base_size = baseSize) +
  theme(legend.position = "none")->p
  return(p)
}
```

2.6 Generate a within-opening performance plot

```
get_within_opening_perf_plot <- function() {
  topN = 17 #median number of applications over 4 (55/4)
```

```
            #-- top 25% of options within each opening.
  d <- read.csv(paste("../../data/evaluation_results/within_openings.csv",
                      sep = "")) %>% filter(n==topN)
get_focal_imprvs = function(algorithm){
    new_d = get_imprvement(d,algorithm) %>% bind_cols(d %>% select(fold))
    new_d %>% rename(improvement = algorithm) %>% mutate(model = algorithm) %>%
    group_by(model) %>% summarise(avg=mean(improvement,na.rm = T),
                                  se = serror(improvement))-> new_d
    return(new_d)
  }
baselines = unique(d$algorithm)
baselines = baselines[baselines != 'hmm']
d %>% pivot_wider(names_from = algorithm, values_from=score)-> d
baselines %>% map_dfr(get_focal_imprvs) -> r
r %>% update_model_names %>% ggplot(aes(x = model, y = avg,
                              ymin = avg - 1.645 * se, ymax = avg + 1.645 * se,
                                          color = '1', shape = '1')) +
  geom_point(size = shape_size) +
  geom_errorbar(width = 0.2) +
  ylab("Performance improvement (%)") +
  xlab(expression(paste(""))) +
  theme_minimal(base_size = baseSize) +
  scale_color_manual(values = c(baseColor, baseColor, baseColor)) +
  scale_shape_manual(name = "", values = c(baseShape, baseShape, baseShape)) +
  theme(legend.position = "none") +
  geom_abline(slope = 0, intercept = 0, linetype = 'dashed')
}
```

2.7 Generate a basic AUC plot

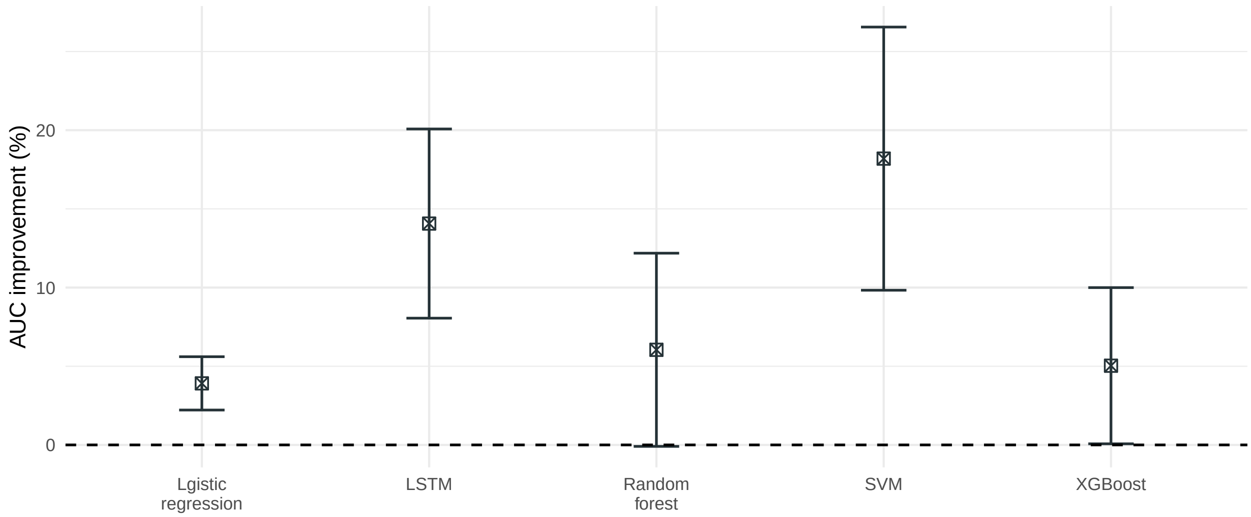
```
get_auc_plot<- function(inputfile) {
d = read_csv(paste("../../data/evaluation_results/",inputfile,sep="")) %>%
  filter(n==0)
get_focal_imprvs = function(algorithm){
    new_d = get_imprvement(d,algorithm) %>% bind_cols(d %>% select(fold))
    new_d %>% rename(improvement = algorithm) %>% mutate(model = algorithm) %>%
    group_by(model) %>% summarise(avg=mean(improvement,na.rm = T),
                                  se = serror(improvement))-> new_d
    return(new_d)
}
baselines = unique(d$algorithm)
baselines = baselines[baselines != 'hmm']
d %>% select(fold,algorithm,score) %>%  pivot_wider(names_from = algorithm,
```

```r
                                                              values_from=score)->d
baselines %>% map_dfr(get_focal_imprvs) -> r
r %>% update_model_names %>% ggplot(aes(x = model, y = avg,
                                        ymin = avg - 1.645 * se,
                                        ymax = avg + 1.645 * se,
                      color = 'r', shape = 'r')) +
  geom_point(size = shape_size) +
  geom_errorbar(width = 0.2) +
  ylab("AUC improvement (%)") +
  xlab(expression(paste(""))) +
  geom_vline(xintercept = c(10.5), linetype = "dashed") +
  theme_minimal(base_size = baseSize) +
  scale_color_manual(values = c(baseColor, baseColor, baseColor)) +
  scale_shape_manual(name = "", values = c(baseShape, baseShape, baseShape)) +
  theme(legend.position = "none") +
  geom_abline(slope = 0, intercept = 0, linetype = 'dashed')->p
return(p)
}
```

3 Creating the paper's figures

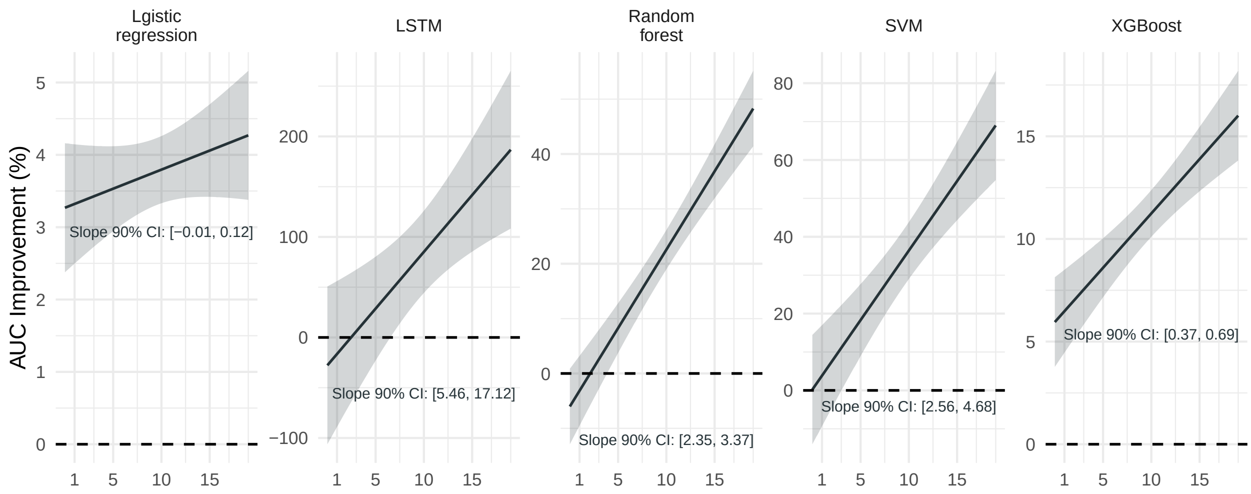
3.1 Figure XX: AUC comparison

```
get_auc_plot('auc_single_assessment.csv') ->p
ggsave(file =
    paste("../../../../../../Apps/Overleaf/gbu/ms/r2/figures/rest_auc.pdf", sep = ""),
    width = 14, height = 5, dpi = 300)
p
```



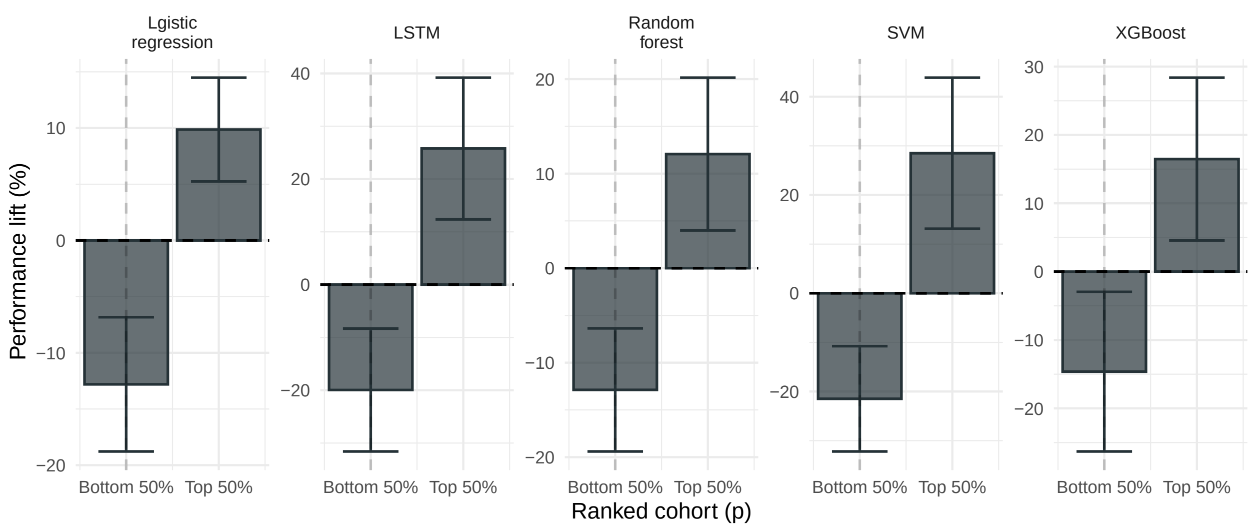
3.2 Figure XX: AUC-n comparison

```
p = get_auc_n_plot()
ggsave(file =
         paste("../../../../../../Apps/Overleaf/gbu/ms/r2/figures/rest_aucn.pdf",
                     sep = ""), width = 16, height = 5, dpi = 300)
p
```



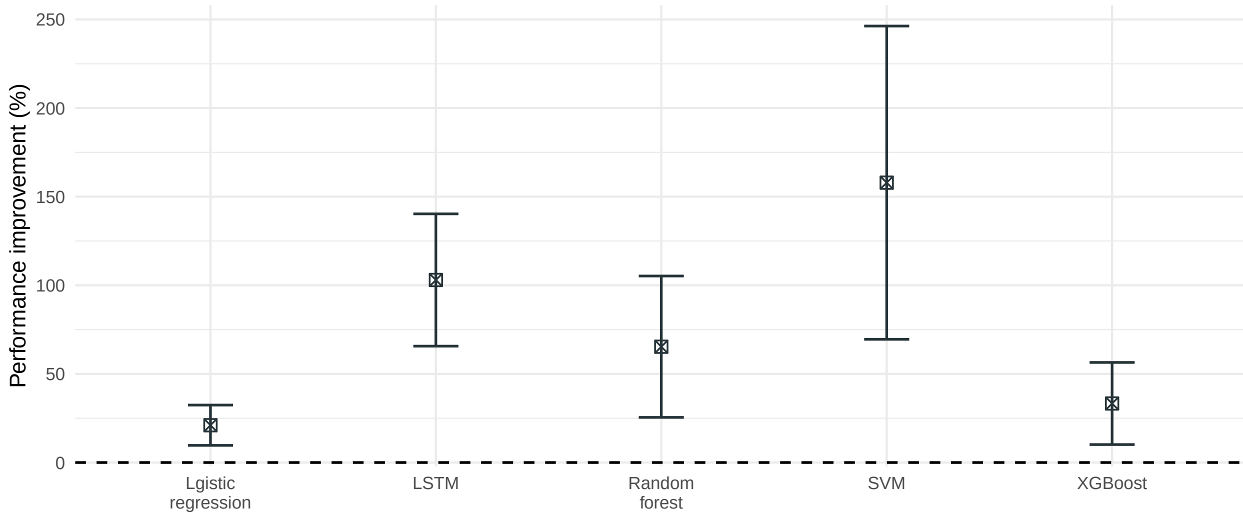
3.3 Figure XX: Ranking performance

```
p = get_ranking_performance_plot()
ggsave(file =
  paste("../../../../../../Apps/Overleaf/gbu/ms/r2/figures/rest_ranking_performance.pdf",
  sep = ""), width = 16, height = 5, dpi = 300)
p
```



3.4 Figure XX: Performance within openings

```
p = get_within_opening_perf_plot()
ggsave(file =
paste("../../../../../../Apps/Overleaf/gbu/ms/r2/figures/rest_withinOpenings.pdf.pdf",
          sep = ""),
    width = 14, height = 5, dpi = 300)
p
```



3.5 Figure XX: AUC comparison – many assessment

```r
get_auc_plot('auc_many_assessment.csv')->p
ggsave(file =
paste("../../../../../../Apps/Overleaf/gbu/ms/r2/figures/rest_many_assessment.pdf",
        sep = ""),
  width = 14, height = 5, dpi = 300)
p
```