Viz for Model Results and Positivity Rates

```
library(data.table)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.3      v purrr    0.3.4
## v tibble  3.1.0      v dplyr    1.0.5
## v tidyr   1.1.3      v stringr 1.4.0
## v readr   1.4.0      v forcats 0.5.1
```

```
## -- Conflicts ------------------------------------------- tidyverse_conflicts() --
## x dplyr::between()   masks data.table::between()
## x dplyr::filter()    masks stats::filter()
## x dplyr::first()     masks data.table::first()
## x dplyr::lag()       masks stats::lag()
## x dplyr::last()      masks data.table::last()
## x purrr::transpose() masks data.table::transpose()
```

```
library(ggthemes)
```
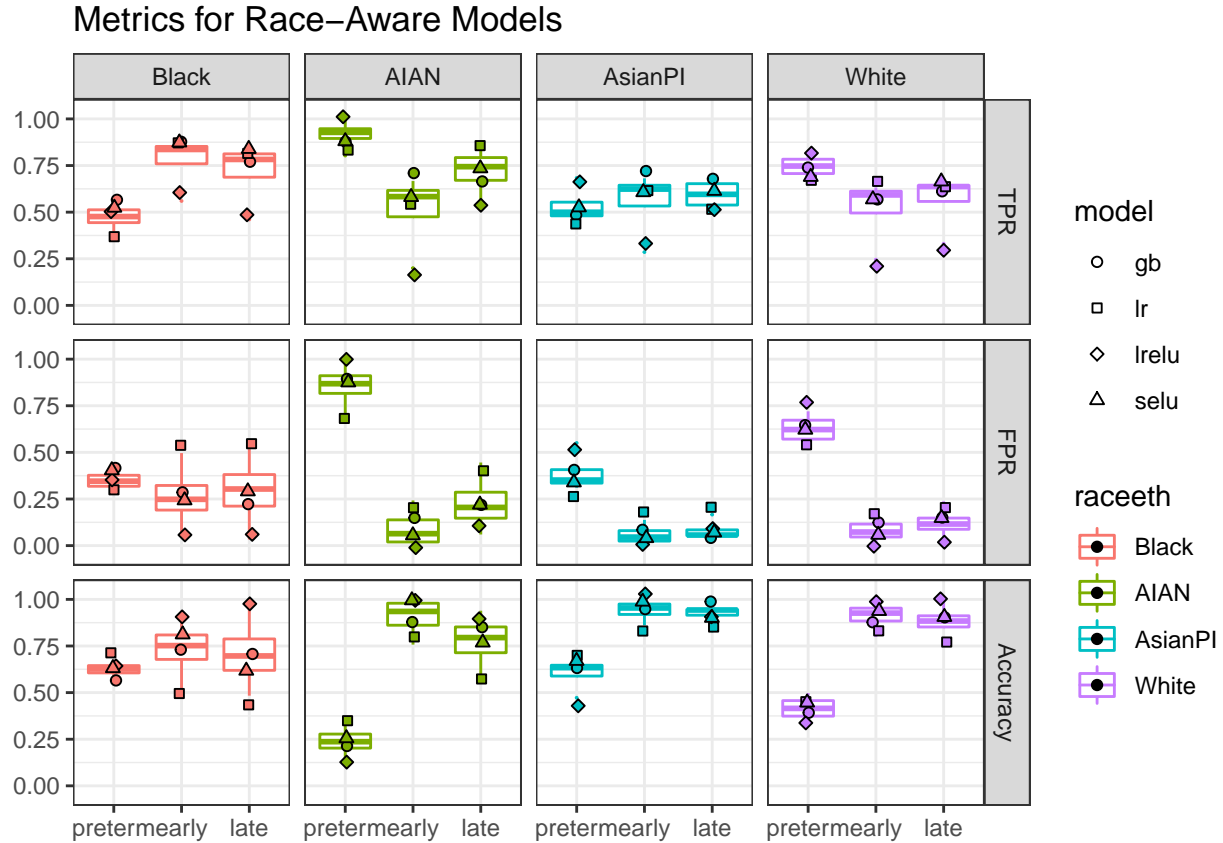
Results

```
results <- fread('../data/results.csv')
# Lengthen
results_long <- results %>%
  pivot_longer(cols = c(TPR, FPR, Accuracy, AUC, TPR10, Positivity), names_to = 'metric', values_to = '
# Relevel race factor for plotting
results_long[results_long$raceeth == 'AmeriIndian', ]$raceeth <- 'AIAN'
results_long$raceeth <-  factor(results_long$raceeth, levels=c('Black', 'AIAN', 'AsianPI', 'White'))
# Relevel task for plotting
results_long$task <- factor(results_long$task, levels=c('preterm', 'early', 'late'))

# Dataframes for our boxplot charts. "Long" form with three metrics of interest.
results_l_3 <- results_long %>%
  filter(metric == 'TPR' | metric == 'FPR' | metric == 'Accuracy')
results_l_3$metric <- factor(results_l_3$metric, levels=c('TPR', 'FPR', 'Accuracy'))
results_l_3_aware <- results_l_3 %>%
  filter(aware == TRUE)
results_l_3_unaware <- results_l_3 %>%
  filter(aware == FALSE)

# Plot all 3 metrics!
g_results <- ggplot(results_l_3_aware, aes(x = task, y = value, color = raceeth)) +
  geom_boxplot(outlier.size = 0) +
  geom_point(aes(shape=model, fill=raceeth), color='black', position = position_jitter(width = 0.05, he
  scale_shape_manual(values=c(21, 22, 23, 24))+
  facet_grid(metric ~ raceeth) +
```

```
  ggtitle('Metrics for Race-Aware Models') +
  ylim(-0.05, 1.05) +
  theme_bw() +
  theme(axis.title = element_blank())
g_results
```

Metrics for Race−Aware Models


```
ggsave('../data/results_boxplot_aware.pdf', width = 13, height = 9, units = 'in', dpi=300)
ggsave('../data/results_boxplot_aware.png', width = 13, height = 9, units = 'in', dpi=300)


g_results <- ggplot(results_l_3_unaware, aes(x = task, y = value, color = raceeth)) +
  geom_boxplot(outlier.size = 0) +
  geom_point(aes(shape=model, fill=raceeth), color='black', position = position_jitter(width = 0.05, he
  facet_grid(metric ~ raceeth) +
  scale_shape_manual(values=c(21, 22, 23, 24))+
  ggtitle('Metrics for Race-Unaware Models') +
  ylim(-0.05, 1.05) +
  theme_bw() +
  theme(axis.title = element_blank())
g_results
```

Metrics for Race−Unaware Models
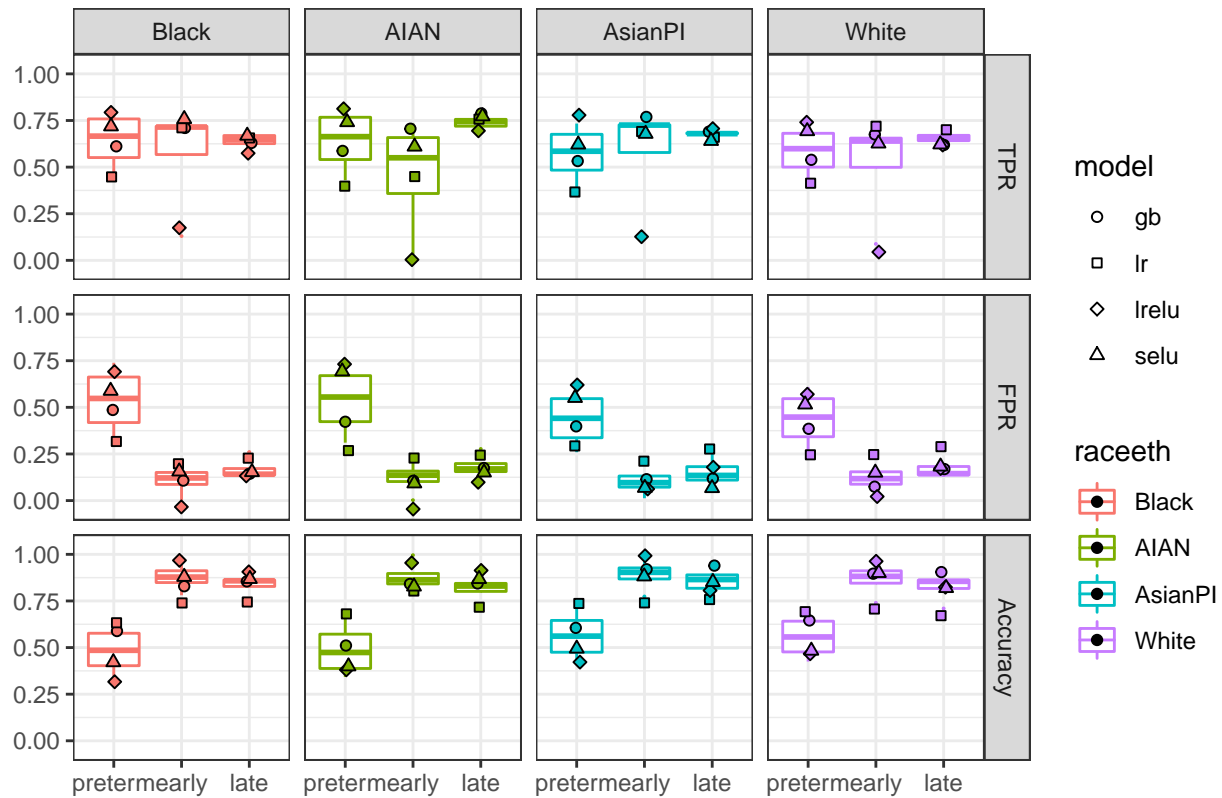

```
ggsave('../data/results_boxplot_unaware.pdf', width = 13, height = 9, units = 'in', dpi=300)
ggsave('../data/results_boxplot_unaware.png', width = 13, height = 9, units = 'in', dpi=300)
```

Data

```
train_sb <- fread('../data/final/stillbirth_train.csv')
train_sb[train_sb == ''] <- NA
train_sb <- train_sb %>%
  mutate(race = case_when(
    race_AmeriIndian == 1 ~ 'AIAN',
    race_AsianPI == 1 ~ 'AsianPI',
    race_Black == 1 ~ 'Black',
    race_White == 1 ~ 'White'
  )) %>%
  select(outcome, race) %>%
  na.omit()

breakdown_late <- train_sb %>%
  mutate(outcome = as.numeric(outcome == 'late stillbirth')) %>%
  table() %>%
  prop.table(margin = 2)
breakdown_late
```

```
##        race
## outcome        AIAN     AsianPI       Black       White
##       0 0.997796497 0.998745093 0.997486491 0.998535573
```

```
##        1 0.002203503 0.001254907 0.002513509 0.001464427
```

```
breakdown_early <- train_sb %>%
  mutate(outcome = as.numeric(outcome == 'early stillbirth')) %>%
  table() %>%
  prop.table(margin = 2)
breakdown_early
```

```
##         race
## outcome          AIAN      AsianPI        Black        White
##       0 0.998149801 0.998417221 0.996007534 0.998276736
##       1 0.001850199 0.001582779 0.003992466 0.001723264
```

```
rm(train_sb)
```

```
train_pt <- fread('../data/final/stillbirth_train.csv')
train_pt[train_pt == ''] <- NA
train_pt <- train_pt %>%
  mutate(race = case_when(
    race_AmeriIndian == 1 ~ 'AIAN',
    race_AsianPI == 1 ~ 'AsianPI',
    race_Black == 1 ~ 'Black',
    race_White == 1 ~ 'White'
  )) %>%
  select(outcome, race) %>%
  na.omit()

breakdown_pt <- train_pt %>%
  mutate(outcome = as.numeric(outcome == 'preterm')) %>%
  table() %>%
  prop.table(margin = 2)
breakdown_pt
```

```
##         race
## outcome         AIAN      AsianPI        Black        White
##       0 0.87224330 0.90314728 0.84478333 0.89816627
##       1 0.12775670 0.09685272 0.15521667 0.10183373
```

```
rm(train_pt)
```

```
# Combine to long format
# Row 2 of "breakdown" tables contain the positivity rates
breakdown_data <- bind_rows(breakdown_late[2,], breakdown_early[2,], breakdown_pt[2,]) %>%
  cbind(task = c('late', 'early', 'preterm')) %>%
  pivot_longer(cols = c('AIAN', 'AsianPI', 'Black', 'White'), names_to = 'raceeth', values_to = 'Positiv
  mutate(source = 'Ground Truth', .before=1)
breakdown_data$raceeth <- factor(breakdown_data$raceeth, levels=c('Black', 'AIAN', 'AsianPI', 'White'))
breakdown_data$task <- factor(breakdown_data$task, levels=c('preterm', 'early', 'late'))

# Just ground truth plot
g_breakdown <- ggplot(breakdown_data, aes(x = raceeth, y = Positivity, fill = raceeth)) +
  geom_col() +
  facet_wrap(. ~ task, scales = 'free') +
  theme_bw() +
  theme(axis.title = element_blank(), legend.position = 'none')
g_breakdown
```
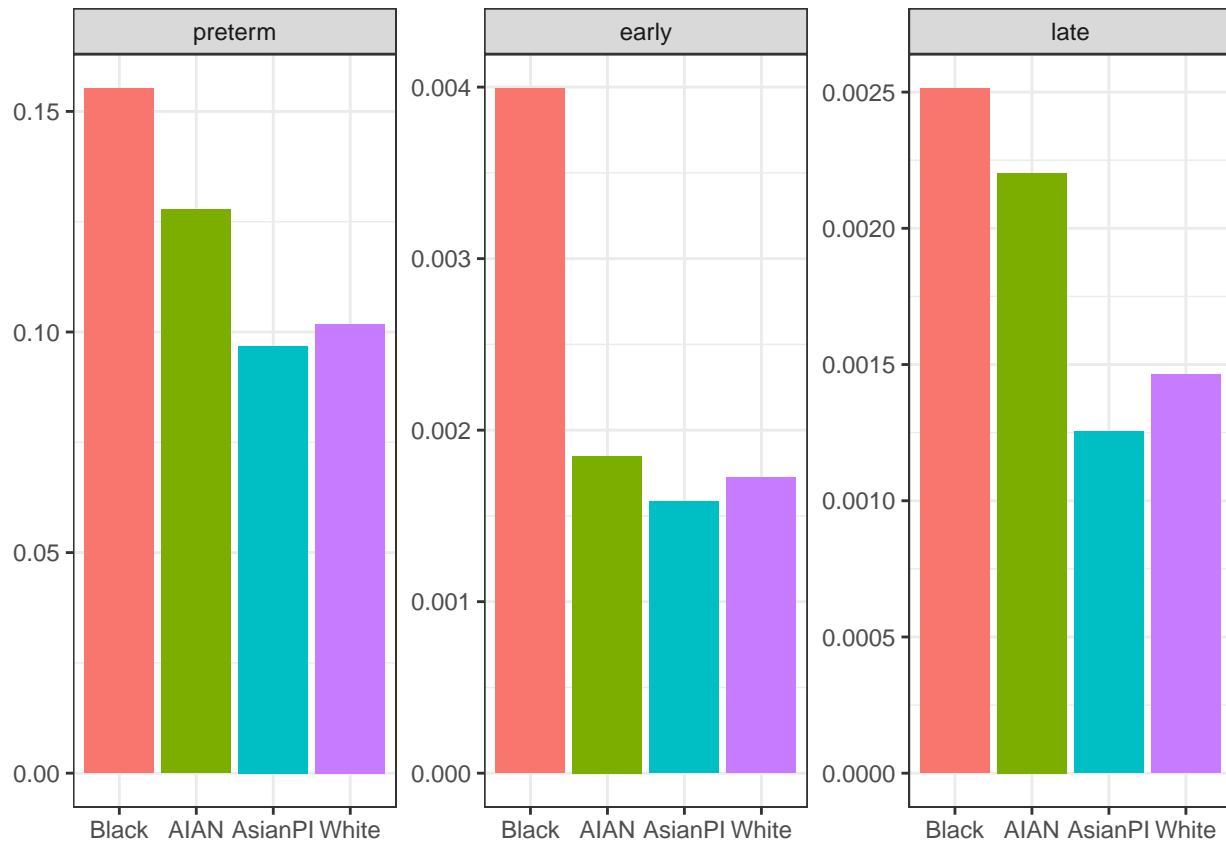
```
ggsave('../data/data_barplot_breakdown.pdf', width = 13, height = 9, units = 'in', dpi=300)
ggsave('../data/data_barplot_breakdown.png', width = 13, height = 9, units = 'in', dpi=300)
```

```
# Now, plot em all.
breakdown_models <- results_long %>%
  filter(metric == 'Positivity') %>%
  select(model, task, raceeth, value, aware) %>%
  rename(Positivity = value, source = model)
breakdown_data_awaredummy <- breakdown_data %>%
  mutate(aware = TRUE)
breakdown_data_unawaredummy <- breakdown_data %>%
  mutate(aware = FALSE)
breakdown <- rbind(breakdown_data_awaredummy, breakdown_data_unawaredummy, breakdown_models) %>%
  mutate(aware = ifelse(aware, 'Race-Aware', 'Race-Unaware'))

# Relevel for consistency
breakdown$raceeth <- factor(breakdown$raceeth, levels=c('Black', 'AIAN', 'AsianPI', 'White'))
breakdown$task <- factor(breakdown$task, levels=c('preterm', 'early', 'late'))
breakdown$source <- factor(breakdown$source, levels=c(
  'Ground Truth', 'gb', 'lr', 'lrelu', 'selu'
))

ggplot(breakdown, aes(x = raceeth, y = Positivity, fill = source, group = source)) +
  geom_col(position='dodge') +
  facet_wrap(aware ~ task) +
  theme_bw() +
  ggtitle('Breakdown of Positivity Rates by Race/Ethnicity', subtitle = 'Across training data ground tr
```

Breakdown of Positivity Rates by Race/Ethnicity

Across training data ground truth and each models' predictions


```
ggsave('../data/data-models_barplot_breakdown.pdf', width = 13, height = 9, units = 'in', dpi=300)
ggsave('../data/data-models_barplot_breakdown.png', width = 13, height = 9, units = 'in', dpi=300)
```