analysis

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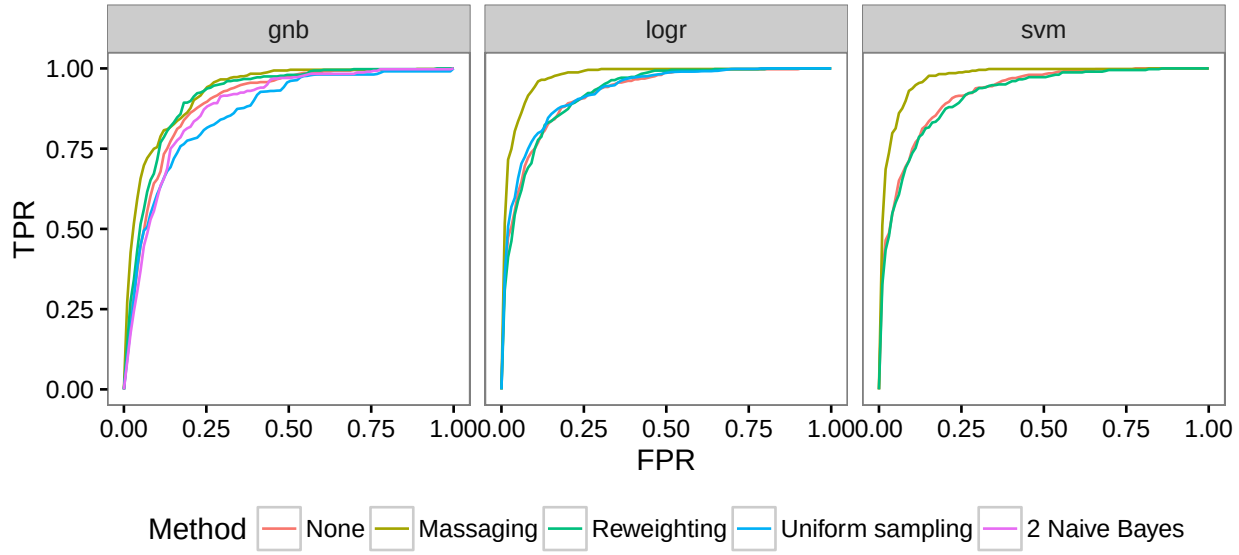
ROC curves

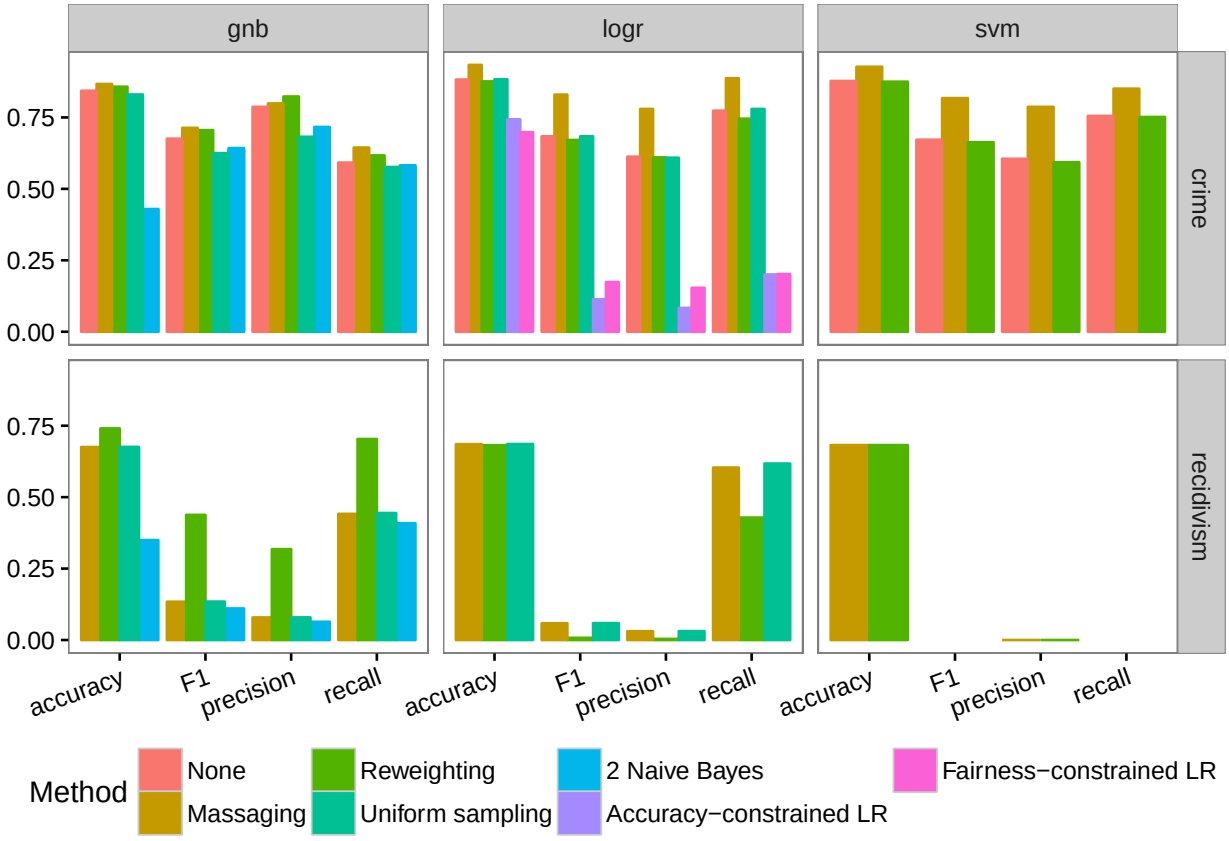
```
roc %>% ggplot(aes(x = fpr, y = tpr, colour = method)) +
  geom_line() +
  facet_wrap(~ model, drop = TRUE) +
  xlab("FPR") + ylab("TPR") +
  #ggtitle("ROC curves for discrimination-reduction methods") +
  guides(colour = guide_legend(title = "Method")) +
  theme_bw() +
  theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
        panel.background = element_blank(), axis.line = element_line(colour = "black"),
        legend.position = "bottom")
```



Accuracy

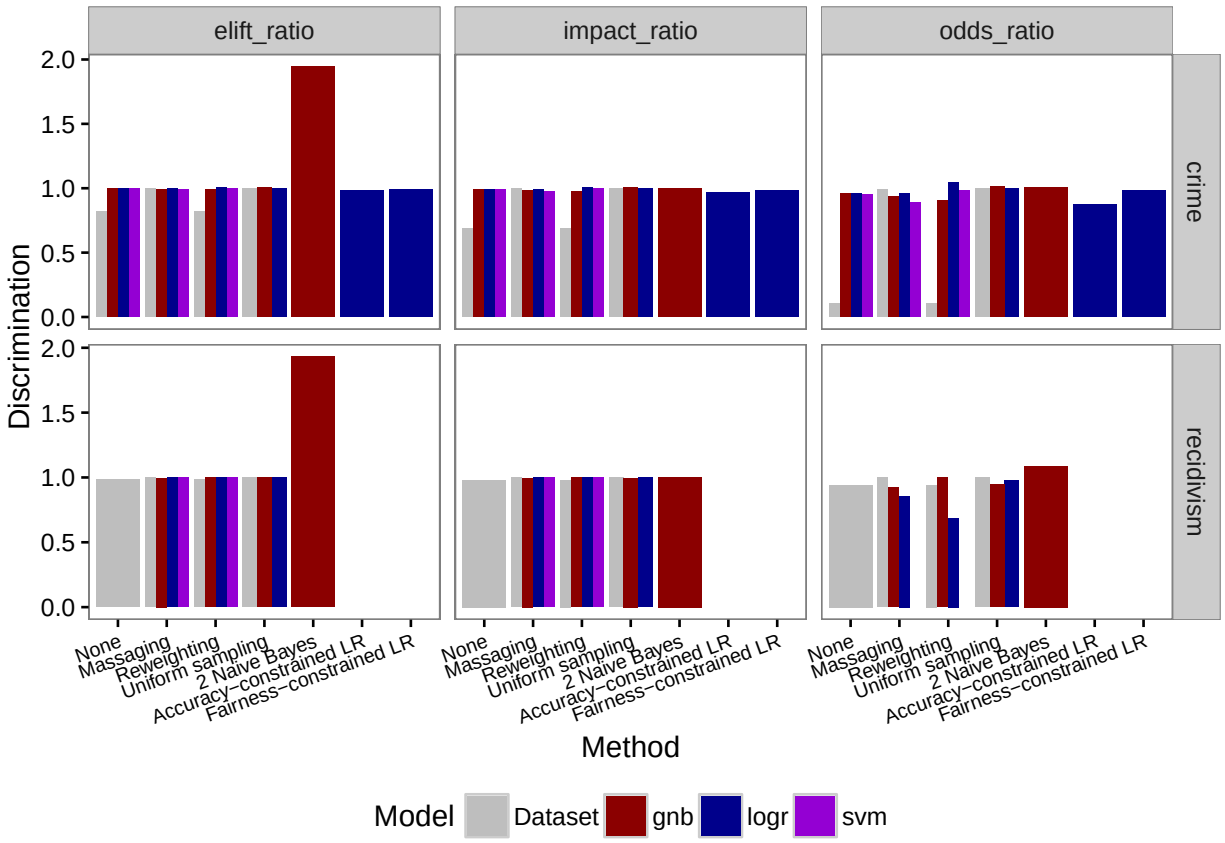
```
acc %>% gather(statistic, value, accuracy, precision, recall, F1) %>%
  ggplot(aes(x = statistic, y = value)) +
  geom_bar(stat = "identity", aes(fill = method, colour = method), position = "dodge") +
  xlab(NULL) + ylab(NULL) +
  guides(fill = guide_legend(title = "Method", nrow = 2), colour = guide_legend(title = "Method")) +
  facet_grid(dataset ~ model, drop = TRUE) +
  theme_bw() +
  theme(axis.text.x = element_text(angle = 20, hjust = 1),
        legend.position = "bottom", panel.grid.major = element_blank(),
```

```
        panel.grid.minor = element_blank(),
        panel.background = element_blank(), axis.line = element_line(colour = "black"))
```



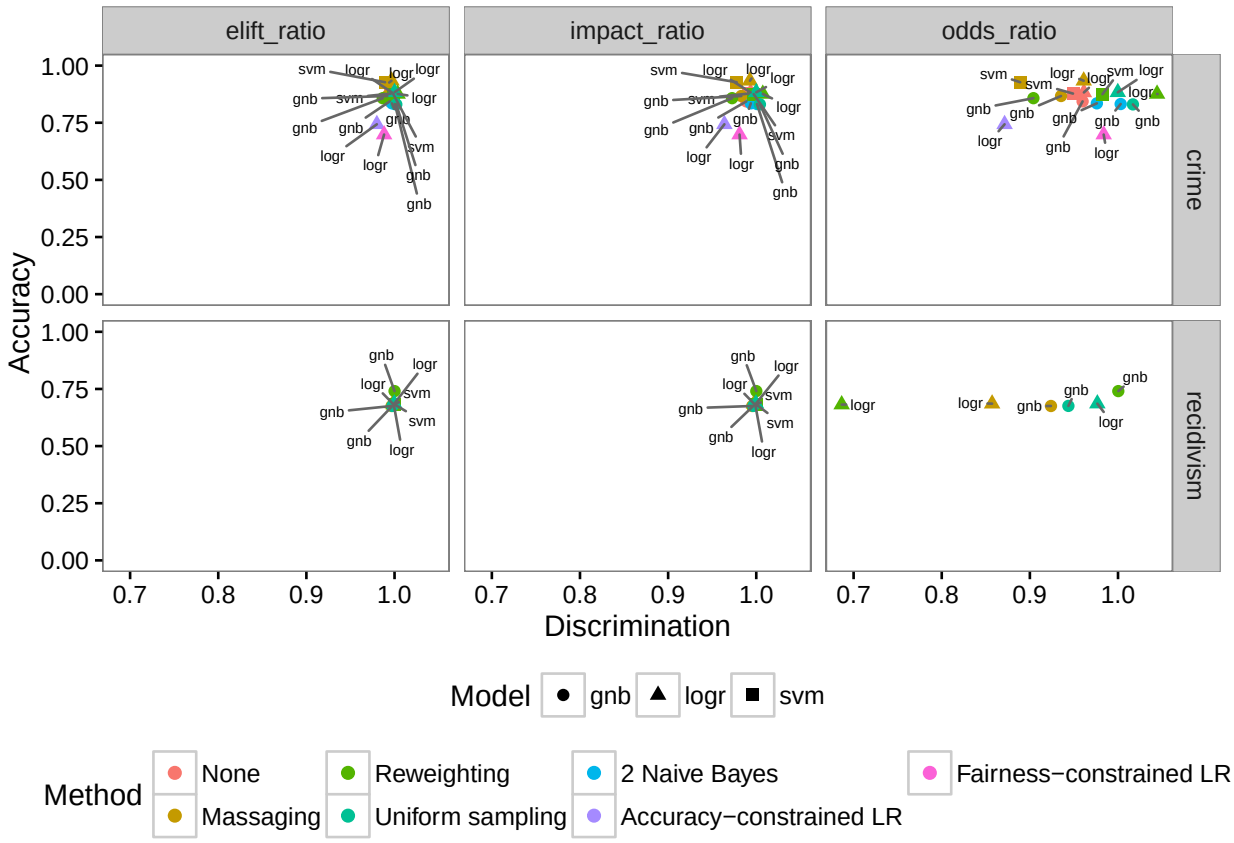
Discrimination

```
comp_tidy %>% gather(measure, value, impact_ratio, odds_ratio, elift_ratio) %>%
  ggplot(aes(x = method, y = value)) +
  geom_bar(stat = "identity", aes(fill = model), position = "dodge") +
  guides(fill = guide_legend(title = "Model")) +
  scale_fill_manual(values = c("gray", "darkred", "darkblue", "darkviolet")) +
  xlab("Method") + ylab("Discrimination") +
  facet_grid(dataset ~ measure, drop = TRUE, scales = "free") +
  theme_bw() +
  theme(axis.text.x = element_text(angle = 20, hjust = 1, size = 8),
        legend.position = "bottom", panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.background = element_blank(), axis.line = element_line(colour = "black"))
```



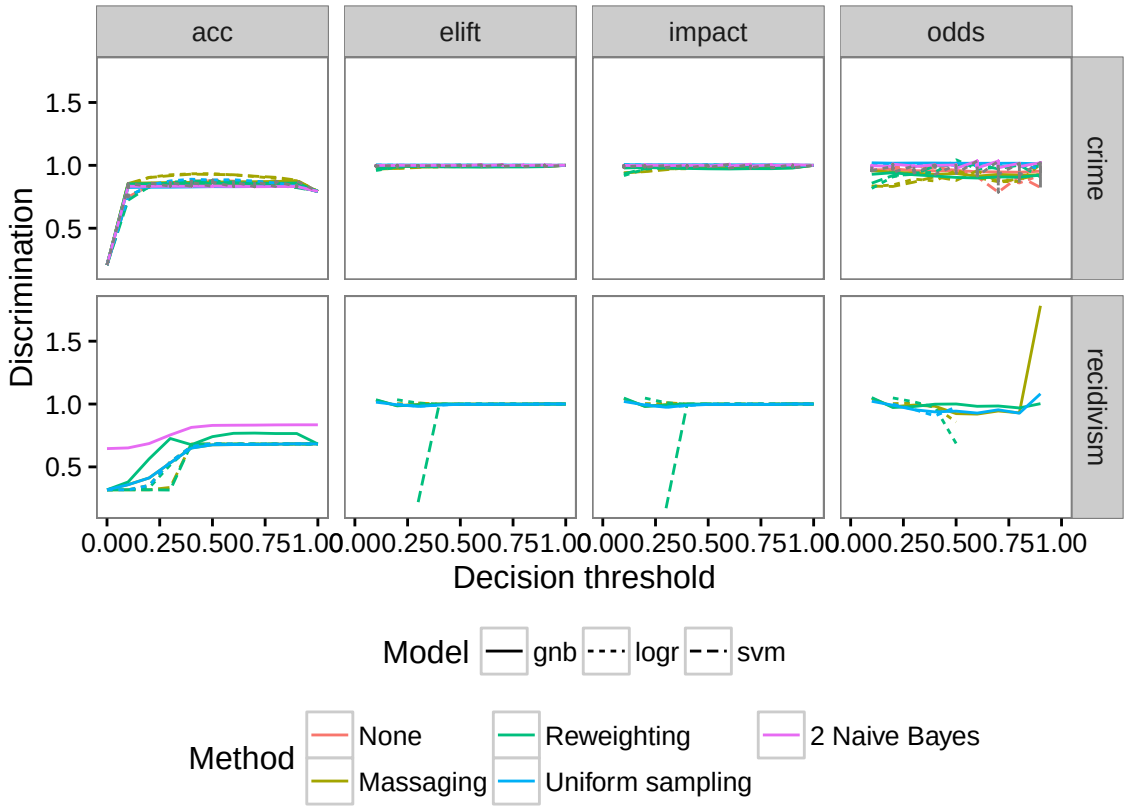
Accuracy vs. discrimination

```
all_tidy %>%
  ggplot(aes(x = value, y = accuracy)) +
  geom_point(aes(colour = method, shape = model), size = 2) +
  guides(colour = guide_legend(title = "Method", nrow = 2)) +
  guides(shape = guide_legend(title = "Model")) +
  ylim(0, 1) +
  xlab("Discrimination") + ylab("Accuracy") +
  geom_text_repel(aes(x = value, y = accuracy, label = model), size = 2) +
  facet_grid(dataset ~ measure, drop = TRUE) +
  theme_bw() +
  theme(legend.position = "bottom") +
  theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
        panel.background = element_blank(), axis.line = element_line(colour = "black"))
```



Impact of threshold

```
thresh %>% gather(statistic, value, elift, impact, odds, acc) %>%
  ggplot(aes(x = thresholds, y = value)) +
  xlab("Decision threshold") + ylab("Discrimination") +
  geom_line(aes(colour = method, linetype = model)) +
  guides(colour = guide_legend(title = "Method", nrow = 2)) +
  guides(linetype = guide_legend(title = "Model")) +
  facet_grid(dataset ~ statistic, drop = TRUE) +
  theme_bw() +
  theme(legend.position = "bottom", panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.background = element_blank(), axis.line = element_line(colour = "black"))
```


acc
elift
impact
odds
crime
recidivism
Discrimination
1.5
1.0
0.5
0.00
0.25
0.50
0.75
1.00
Decision threshold
Model
gnb
logr
svm
Method
None
Massaging
Reweighting
Uniform sampling
2 Naive Bayes