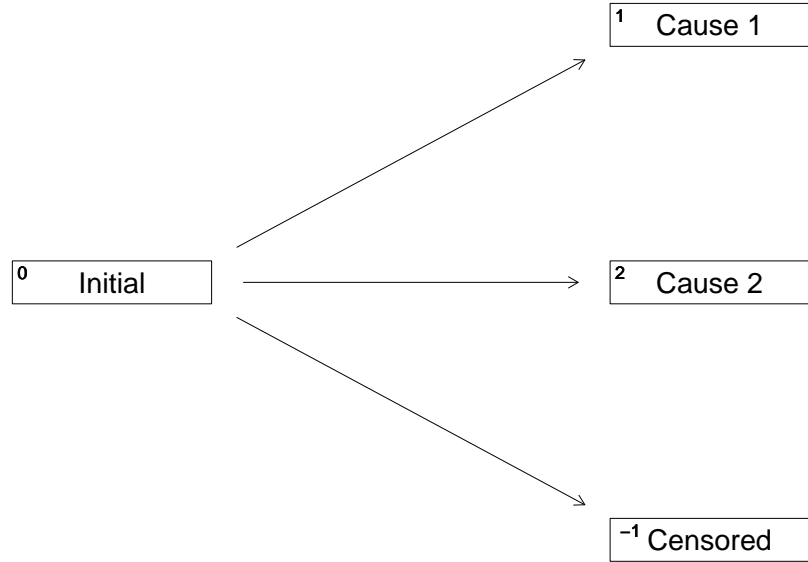# Make figures for article

Anders Munch

July 5, 2025

1 Setup and load data

2 Multi state illustration

```
library(prodlim)
library(here)
nTrans <- 3
stateLabels = c("Initial","Cause_1", "Cause_2", "Censored")
crHist <- Hist(time = 1:nTrans, event = list(from = rep("1", nTrans), to =
plot(crHist, stateLabels = stateLabels, arrowLabels = FALSE,
     tagBoxes = c(0,1,2,-1),
     box.width = 25)
```
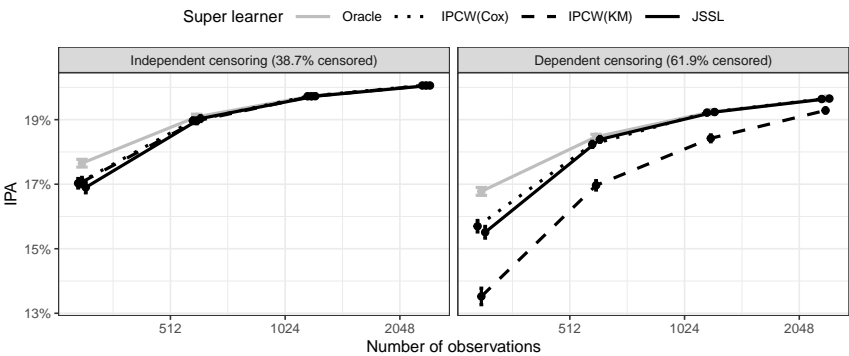
3 Numerical experiments

Marginal event and censoring probabilities:

time	$\text{sim}_{\text{setting}}$	$\text{true}_{\text{events}}$	$\text{true}_{\text{cens}}$	at_{risk}
36	original	24.619	61.853	25.774
36	$\text{indep}_{\text{cens}}$	24.674	38.740	46.141

3.1 IPCW based super learners

$\mathrm{ipa\_plot}(\mathbf{data} = \mathrm{summ\_zel\_sim2\_1}[\mathbf{time} == 36\ \&\ \mathrm{type} == "event"\ \&\ \mathrm{SL}\ \mathbf{!=}\ "sur$
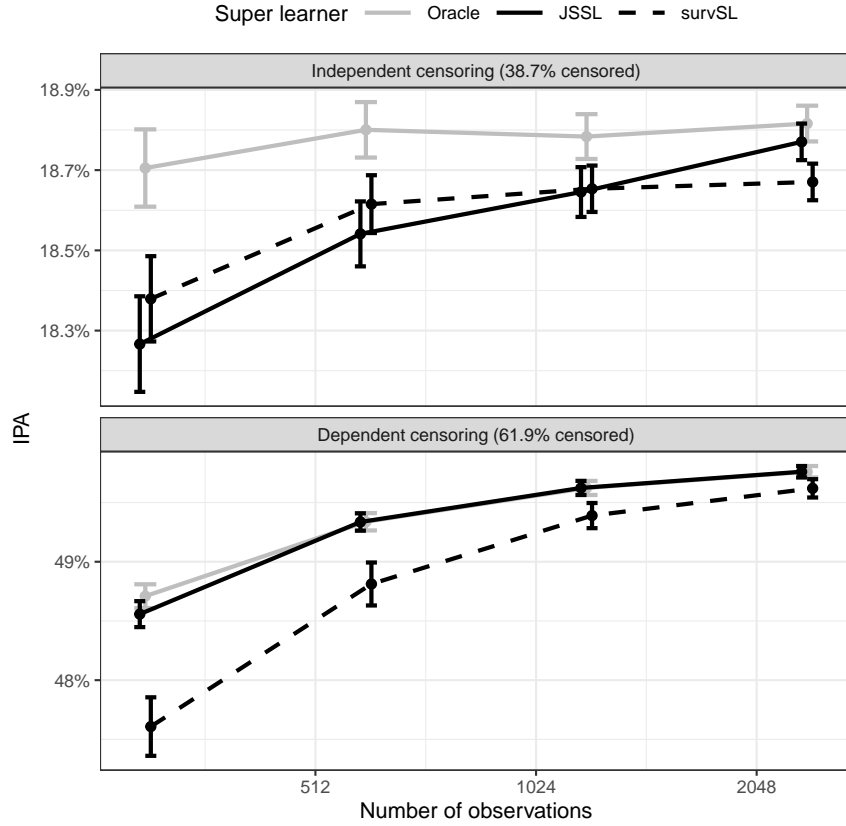
3.2 State learner versus survSL

```
ipa_plot(data = summ_zel_sim2_1[time == 36 & type == "event" & !grepl("IPC
         linetype_vals = c(1,1,2))
```
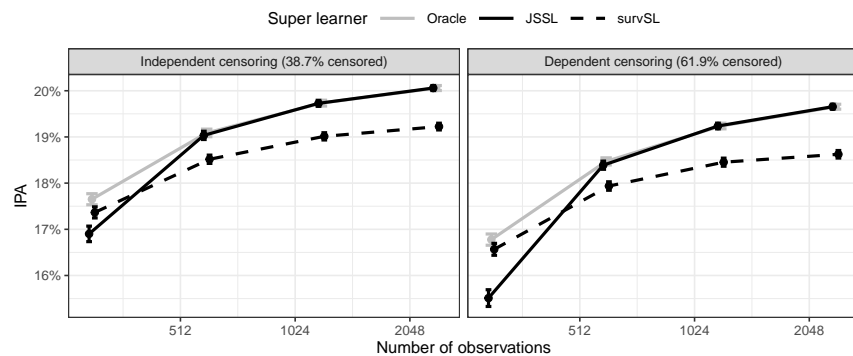


```
ipa_plot(data = summ_zel_sim2_1[time == 36 & type == "cens" & !grepl("IPC
         linetype_vals = c(1,1,2), scales = "free_y", nrow = 2, ncol = 1)
```

4 Data application with competing event

4.1 Table 1

```
\begin{tabular}{ l| c c c c c }
 Rank&Cause 1&Cause 2&Censored&Loss&SD \\\hline
\hline
 $   1.0000 $&Elastic net&Elastic net&Random forest&$  7.0205 $&$ 0.030977 $ \\
\hline
 $   2.0000 $&LASSO&Elastic net&Random forest&$  7.0209 $&$ 0.031035 $ \\
\hline
 $   3.0000 $&Cox&Elastic net&Random forest&$  7.0224 $&$ 0.030871 $ \\
\hline
 $   4.0000 $&Elastic net&LASSO&Random forest&$  7.0225 $&$ 0.030170 $ \\
\hline
```

```
$   5.0000 $&LASSO&LASSO&Random forest&$  7.0228 $&$ 0.030237 $ \\
\hline
$  25.0000 $&Random forest&Random forest&LASSO&$  7.3845 $&$ 0.026975 $ \\
\hline
$  50.0000 $&Elastic net&Random forest&LASSO&$  7.3974 $&$ 0.021290 $ \\
\hline
$  75.0000 $&LASSO&Cox&LASSO&$  7.4059 $&$ 0.024660 $ \\
\hline
$ 100.0000 $&Nelson-Aalen&Cox&Elastic net&$  7.8300 $&$ 0.016719 $ \\
\hline
$ 125.0000 $&Nelson-Aalen&Nelson-Aalen&Nelson-Aalen&$ 10.3298 $&$ 0.003289 $ \\
\end{tabular}

zel_real_plot_dt <- copy(zelefsky_statelearner$cv_fit)
learners_levels <- c("km","cox_unpenalized","cox_lasso","cox_elastic","rf")
learners_labels <- c("Nelson-Aalen","Cox","LASSO","Elastic_net","Random_for
zel_real_plot_dt[,cause1:=factor(cause1,levels=learners_levels,labels=learn
zel_real_plot_dt[,cause2:=factor(cause2,levels=learners_levels,labels=learn
## zel_real_plot_dt[,censor:=factor(censor,levels=learners_levels,labels=pa
zel_real_plot_dt[,censor:=factor(censor,levels=learners_levels,labels=learn
library(tidyverse)
df <- zel_real_plot_dt
df <- df[,label_wrapped:= str_wrap(paste(cause1,cause2,censor,collapse = ",

ggplot(df[cause2 == "Random_forest"], aes(x = loss)) + geom_bar(stat="ident

ggplot(zel_real_plot_dt, aes(x = cause1, y = cause2, fill = loss)) +
  geom_tile(color = "white") +
  facet_wrap(~censor) +
  scale_fill_viridis_c(option = "C") +
  labs(title = "Performance_by_Learner_Combinations",
       x = "Cause_1_Learner", y = "Cause_2_Learner", fill = "Performance")
  theme_minimal()

library(ggplot2)
ggplot(zel_real_plot_dt, aes(x = cause1, y = loss, col = cause2)) +
  geom_point(position=position_dodge(width=1), size=.8) +
  geom_errorbar(aes(ymin = loss-2*sd, ymax = loss+2*sd), width = .4,
                position=position_dodge(width=1)) +
  theme_bw() + ylab("Integrated_Brier_score") +
```
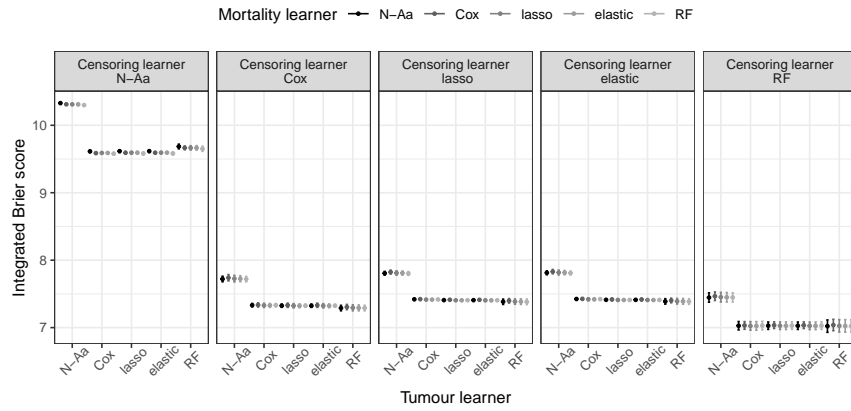
```
    theme(legend.position="top",
          axis.text.x = element_text(angle = 45, vjust = .8)) +
    xlab("Tumour_learner") +
    facet_grid( ~ censor) +
    scale_colour_grey("Mortality_learner", start = 0, end = 0.7)

zel_real_plot_dt <- copy(zelefsky_statelearner$cv_fit)
learners_levels <- c("km","cox_strata_stage","cox_lasso","cox_elastic","rf"
learners_labels <- c("N–Aa","Cox","lasso","elastic","RF")
zel_real_plot_dt[,cause1:=factor(cause1,levels=learners_levels,labels=learn
zel_real_plot_dt[,cause2:=factor(cause2,levels=learners_levels,labels=learn
zel_real_plot_dt[,censor:=factor(censor,levels=learners_levels,labels=paste

library(ggplot2)
ggplot(zel_real_plot_dt, aes(x = cause1, y = loss, col = cause2)) +
  geom_point(position=position_dodge(width=1), size=.8) +
  geom_errorbar(aes(ymin = loss-2*sd, ymax = loss+2*sd), width = .4,
                  position=position_dodge(width=1)) +
  theme_bw() + ylab("Integrated_Brier_score") +
  theme(legend.position="top",
          axis.text.x = element_text(angle = 45, vjust = .8)) +
  xlab("Tumour_learner") +
  facet_grid( ~ censor) +
  scale_colour_grey("Mortality_learner", start = 0, end = 0.7)
```


Table

4.2   Target parameter

```
ate_est_inter_eff[effect == "ATE" & est_type == "one-step"] |>
  (\(plot_data)
    {
      plot_data[, cause:=factor(cause, levels=c("cause1","cause2"), labels=c
      ggplot(plot_data, aes(x = time, y = est)) +
        geom_errorbar(aes(ymin = lower, ymax = upper), width = 1) +
        geom_point() +
        geom_hline(yintercept = 0, linetype = 2) +
        theme_bw() +
        facet_wrap( ~ cause) +
        xlab("Months after baseline") + ylab("Average treatment effect of
        scale_x_continuous(breaks = seq(6,36,12)) +
        scale_y_continuous(labels = scales::percent)
    })()
```