Figure 3.1. An ontology of performance metrics. (KL, Kullback–Leibler; BIR, Bayesian information reward; K & B IR, Kononenko and Bratko information reward.)

CUMULATIVE RESPONSE AND MODEL PERFORMANCE

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DATA 607

3/18/20

PRESENTATION GOALS

- Definitions

- Practical example: plot in R *caret* package

- Strengths and weaknesses of this measure

CUMULATIVE RESPONSE: DEFINITION

- Proportional measure of model performance

- X-axis: percentage of population tested

- Y-axis: proportion of true positives

- Related measure: lift and lift curve

- Visuals may be confused with each other

CUMULATIVE RESPONSE VISUALLY

Comparison of several classifiers

Vertical axis:
 percent true positive, or
hit rate

Blue line y = x
Random guess

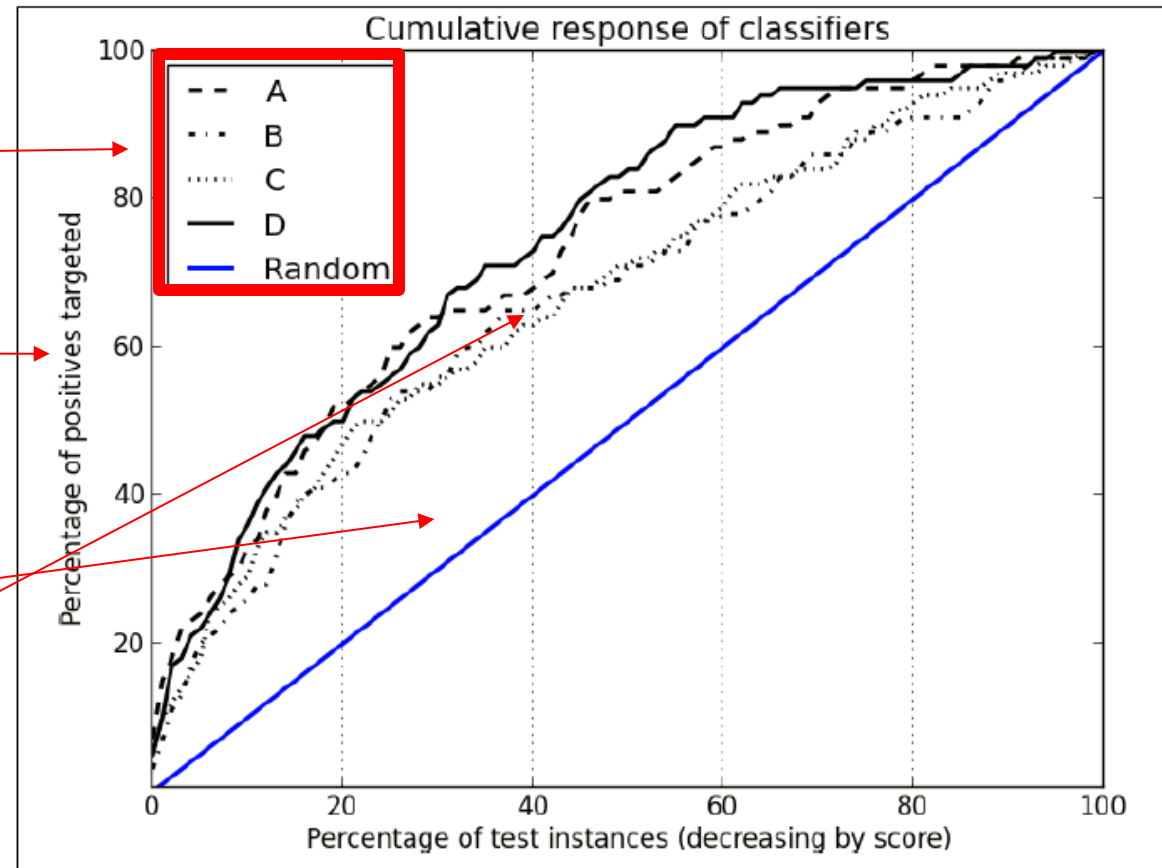More efficient =
Steeper slope

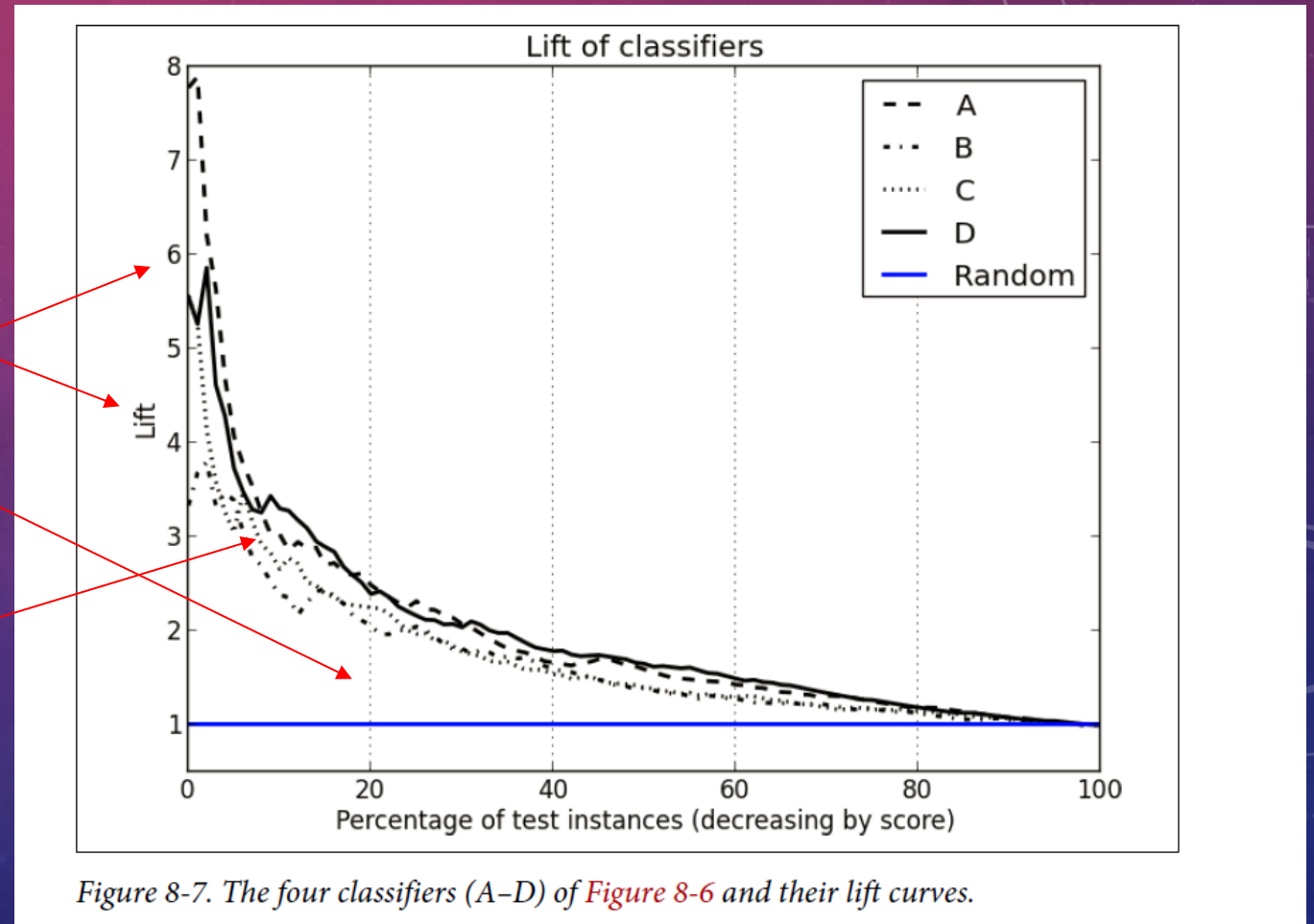Figure 8-6. Four example classifiers (A–D) and their cumulative response curves.

COMPARISON: LIFT CURVE

Y axis of cumulative response divided by x-axis

Blue line: y = x, Same as before

"y times more lift" = **"y better than random"**

Effective classifiers get more positives relative to sample

Figure 8-7. The four classifiers (A–D) of Figure 8-6 and their lift curves.

EXAMPLE: CARET PACKAGE

Classification **A**nd **RE**gression **T**raining

```r
16 ```{r caret-example-data}
17 set.seed(2)
18 lift_training <- twoClassSim(1000)
19 lift_testing  <- twoClassSim(1000)
20
21 ctrl <- trainControl(method = "cv", classProbs = TRUE,
22                      summaryFunction = twoClassSummary)
23
24 set.seed(1045)
25 fda_lift <- train(Class ~ ., data = lift_training,
26                   method = "fda", metric = "ROC",
27                   tuneLength = 20,
28                   trControl = ctrl)
29 set.seed(1045)
30 lda_lift <- train(Class ~ ., data = lift_training,
31                   method = "lda", metric = "ROC",
32                   trControl = ctrl)
33
34 library(C50)
35 set.seed(1045)
36 c5_lift <- train(Class ~ ., data = lift_training,
37                  method = "C5.0", metric = "ROC",
38                  tuneLength = 10,
39                  trControl = ctrl,
40                  control = C5.0Control(earlyStopping = FALSE))
41
42 ## Generate the test set results
43 lift_results <- data.frame(Class = lift_testing$Class)
44 lift_results$FDA <- predict(fda_lift, lift_testing, type = "prob")[,"Class1"]
45 lift_results$LDA <- predict(lda_lift, lift_testing, type = "prob")[,"Class1"]
46 lift_results$C5.0 <- predict(c5_lift, lift_testing, type = "prob")[,"Class1"]
47 head(lift_results)
48 ```
```

http://topepo.github.io/caret/index.html

EXAMPLE: CARET VISUAL
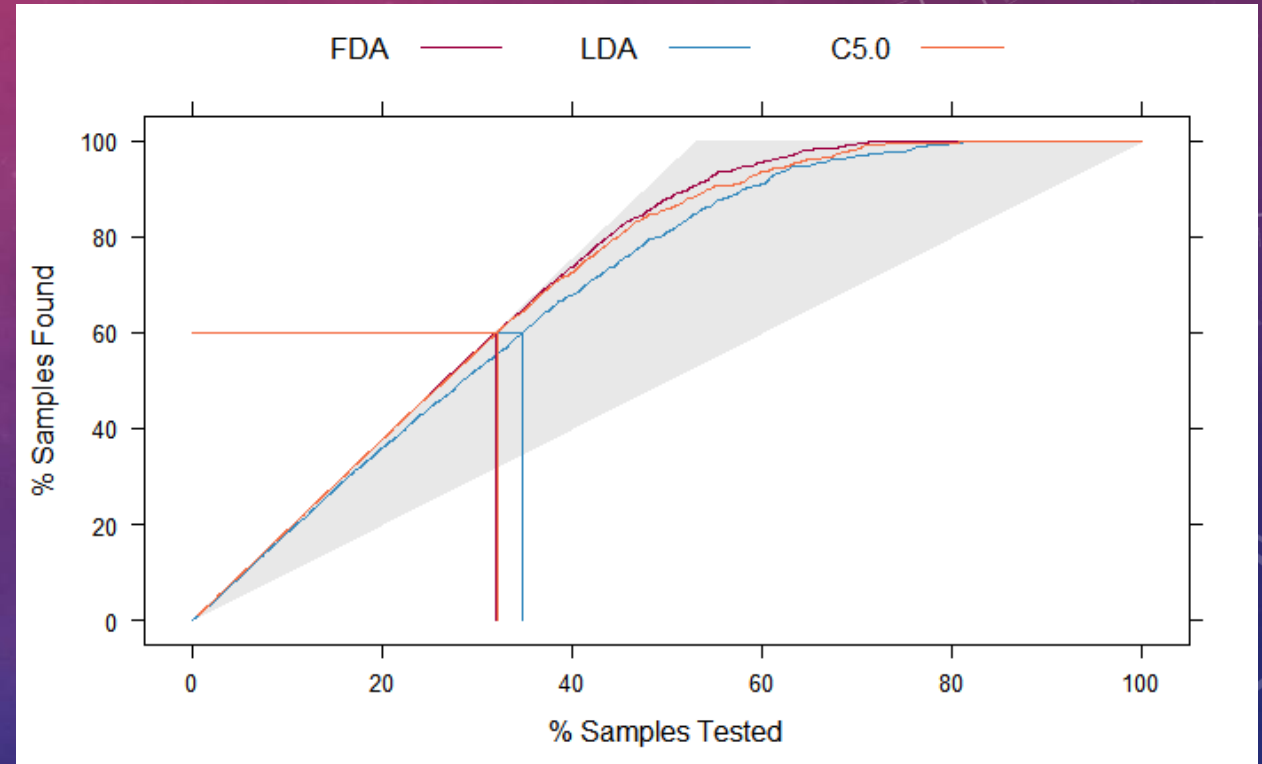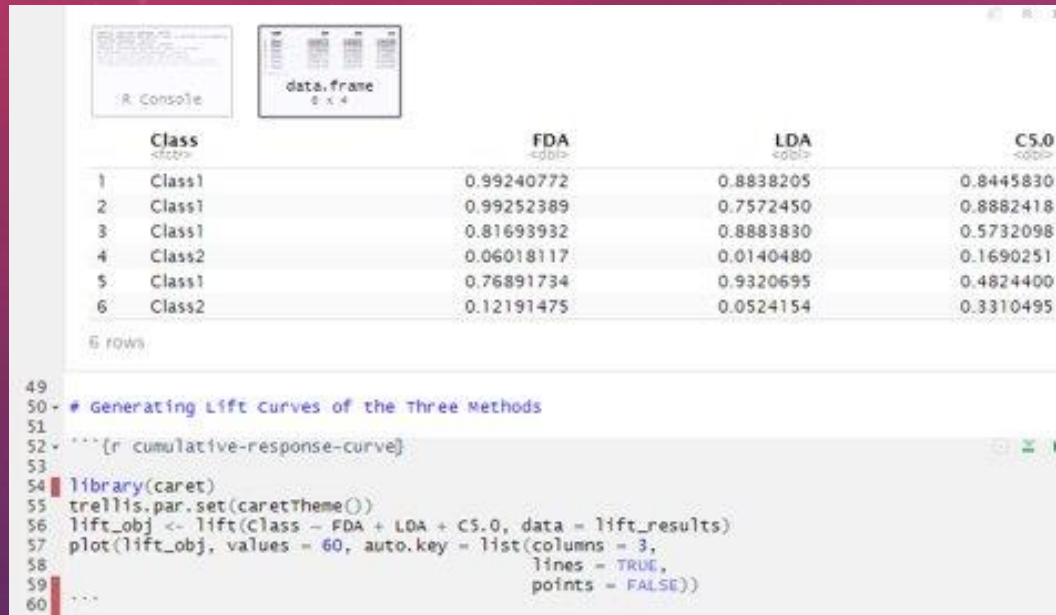
STRENGTHS AND LIMITATIONS

- **Strength**: Intuitive representation

- *Weakness*: hard to generalize to scenarios with different class proportions

- **Strength**: can be run without known operations costs

- *Weakness*: cannot measure the profitability of a model

- **Strength**: considers beyond the accuracy of a model

- *Weakness*: No direct comparison between all *tp* and *fp* rates (ROC space)

QUESTIONS?

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