Pillar 1 - Conformal Prediction

DARS

2019-05-09

1 Set up

2 Course selection

I select courses with large and small n, and large and small CV error. I do not select courses whose lasso model contains less than 3 non-zero coefficients (df).

- COR1002: large n
- COR1004: large n and smaller CV error (mean absolute error) than COR1002
- SCI3003: small n and large CV error
- SCI2040: small n and small CV erro
- SSC3044: small CV error
- SSC3038: small CV error and n twice as large as SSC3044
- SCI2018: large CV error
- SCI2010: large CV error and n twice as large as SCI2018

```
## # A tibble: 8 x 4
##   target      n cv_error    df
##   <chr>   <dbl>    <dbl> <dbl>
## 1 SSC3044   136    0.382    13
## 2 SSC3038   272    0.398     7
## 3 SCI2040    29    0.546     9
## 4 COR1004  1998    0.669    22
## 5 COR1002  2067    0.998    20
## 6 SCI2010   417    1.41     18
## 7 SCI2018   198    1.62     14
## 8 SCI3003    30    1.83     14
```

3 Conformal Prediction setp by step

3.1 Cross-validation

3.2 Training, callibration and test sets

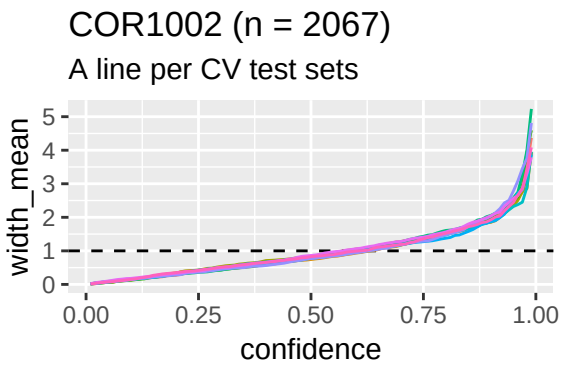
3.3 Fit lasso on training set

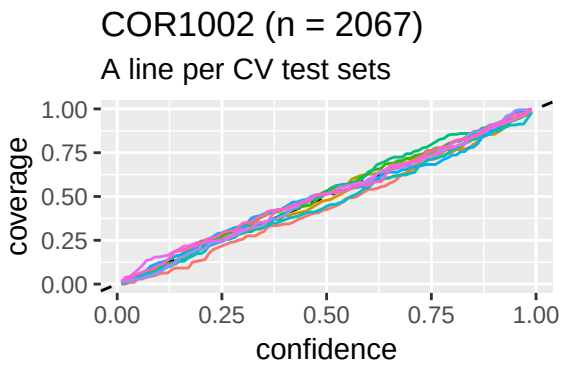
3.4 Compute non-conformity scores on callibration test

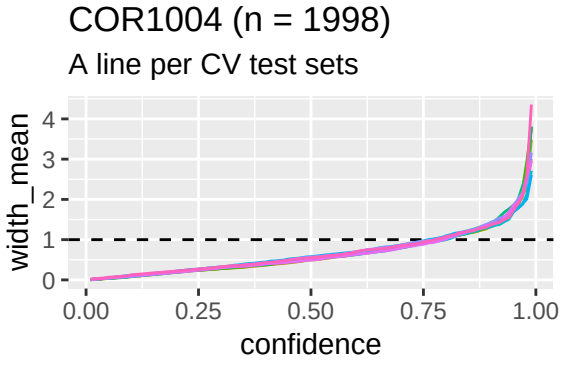
3.5 Evaluate coverage on test set

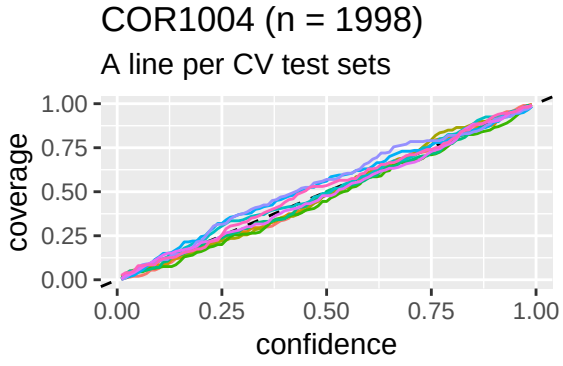
Grade prediction on test set

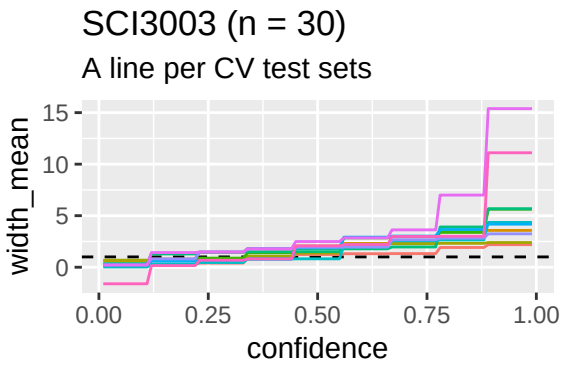
4 Loop through all courses

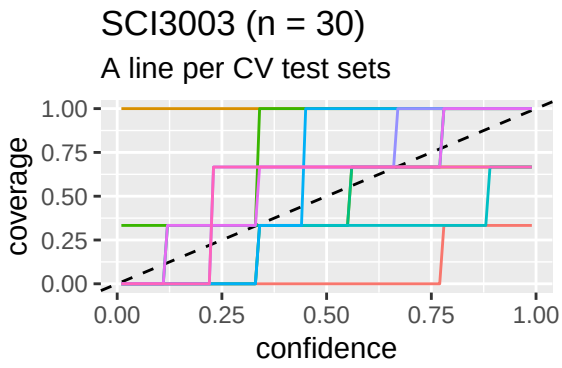


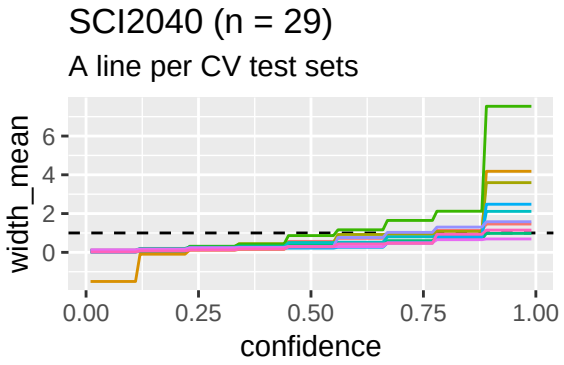


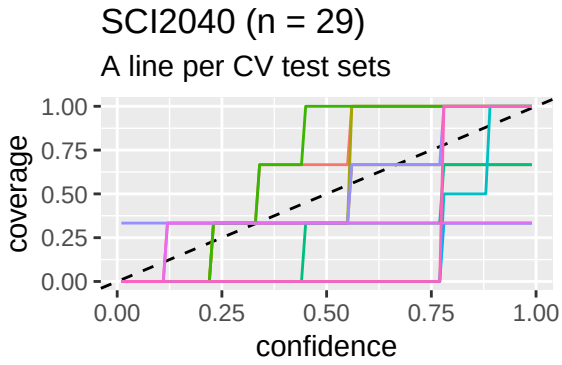


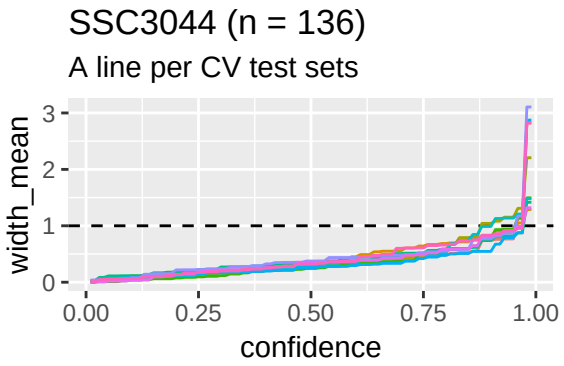


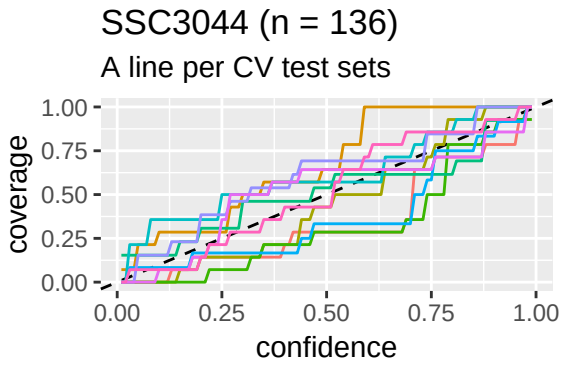

SCI3003 (n = 30)
A line per CV test sets
width_mean
15
10
5
0
0.00
0.25
0.50
0.75
1.00
confidence

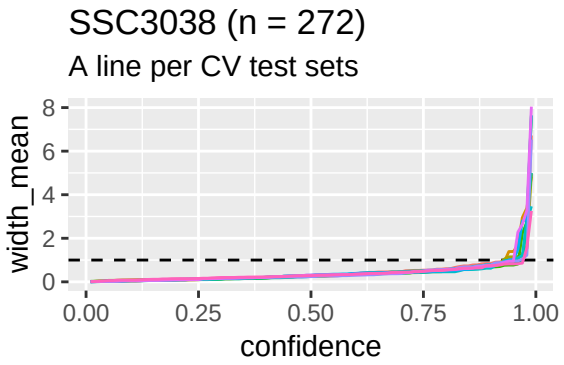

SCI3003 (n = 30)
A line per CV test sets
coverage
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
confidence

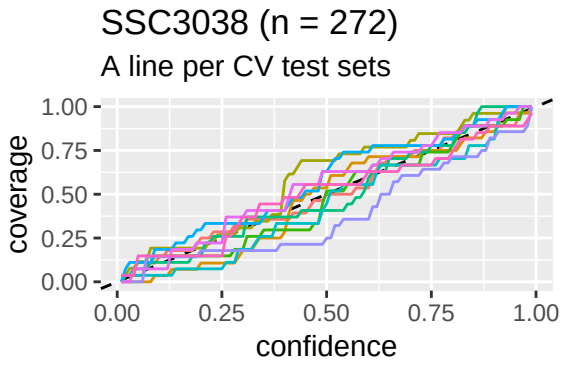

SCI2040 (n = 29)
A line per CV test sets
width_mean
6
4
2
0
0.00
0.25
0.50
0.75
1.00
confidence


SCI2040 (n = 29)
A line per CV test sets
coverage
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
confidence


SSC3044 (n = 136)
A line per CV test sets
width_mean
3
2
1
0
0.00
0.25
0.50
0.75
1.00
confidence


SSC3044 (n = 136)
A line per CV test sets
coverage
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
confidence


SSC3038 (n = 272)
A line per CV test sets
width_mean
8
6
4
2
0
0.00
0.25
0.50
0.75
1.00
confidence


SSC3038 (n = 272)
A line per CV test sets
coverage
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
confidence

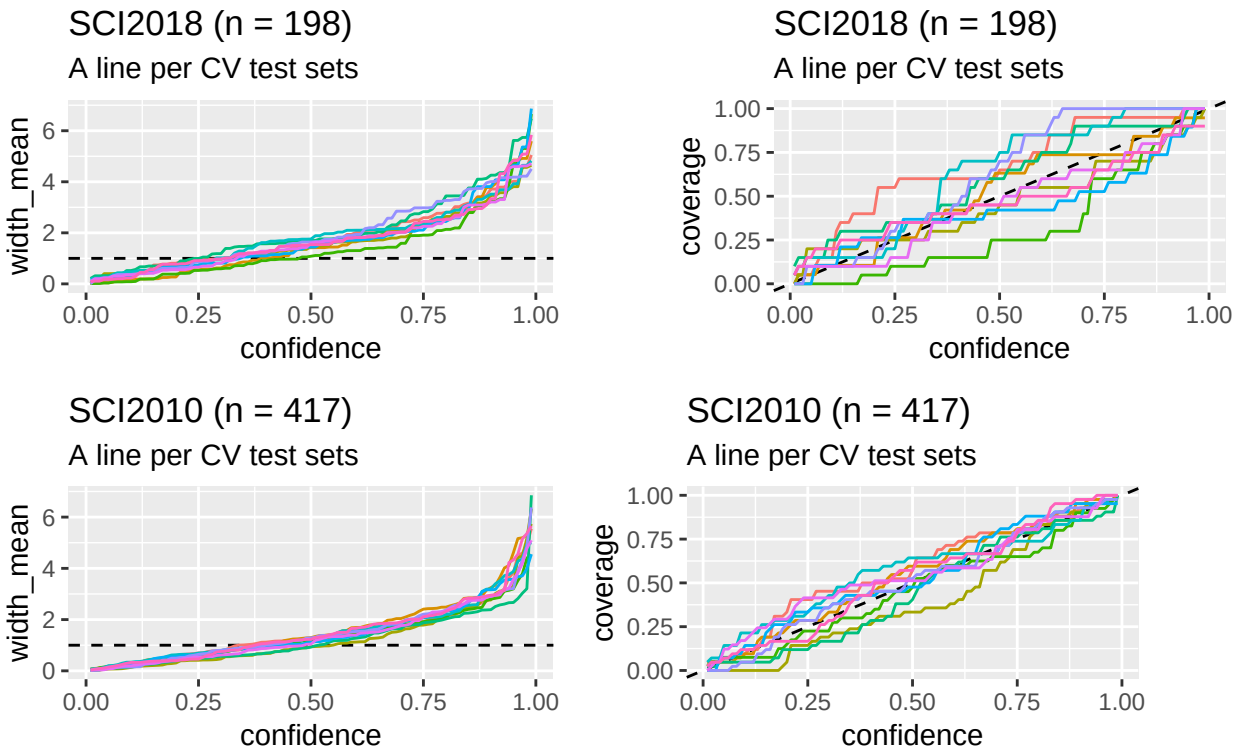


Illustration of the effect of error_hat on interval's width

```
## # A tibble: 42 x 81
##        Y   GPA GPA_HUM GPA_SCI GPA_SSC GPA_COR GPA_SKI GPA_PRO Topic_1
##    <dbl> <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
##  1   8    8.06    7.31    7.31    8.7     7.1     7.9     7.9   0.0318
##  2   8.7  6.71    7.31    8.5     6.64    4.77    7.05    7.87  0.0715
##  3   9.7  8.68    7.9     7.31    9.06    8       8.62    8.2   0.117
##  4   6    7.4     6.8     9       7.31    6.6     7.1     8.1   0.0279
##  5   9.7  7.69    7.6     7.8     7.96    6.53    7.85    7.58  0.147
##  6   5.8  6.61    7.25    5.9     6.74    5.78    7       7.42  0.152
##  7   5    7.86    7.31    7.31    7.92    8.35    7.15    8.03  0.104
##  8   9    7.73    7       8.3     6.6     9.1     8       7.4   0.0403
##  9   5.5  7.36    7.4     7.89    6.97    6.45    7.6     8     0.137
## 10   7.8  7.05    7.31    7.08    7.39    6       7.42    6.78  0.133
## # ... with 32 more rows, and 72 more variables: Topic_10 <dbl>,
## #   Topic_11 <dbl>, Topic_12 <dbl>, Topic_13 <dbl>, Topic_14 <dbl>,
## #   Topic_15 <dbl>, Topic_16 <dbl>, Topic_17 <dbl>, Topic_18 <dbl>,
## #   Topic_19 <dbl>, Topic_2 <dbl>, Topic_20 <dbl>, Topic_21 <dbl>,
## #   Topic_22 <dbl>, Topic_23 <dbl>, Topic_24 <dbl>, Topic_25 <dbl>,
## #   Topic_26 <dbl>, Topic_27 <dbl>, Topic_28 <dbl>, Topic_29 <dbl>,
## #   Topic_3 <dbl>, Topic_30 <dbl>, Topic_31 <dbl>, Topic_32 <dbl>,
## #   Topic_33 <dbl>, Topic_34 <dbl>, Topic_35 <dbl>, Topic_36 <dbl>,
## #   Topic_37 <dbl>, Topic_38 <dbl>, Topic_39 <dbl>, Topic_4 <dbl>,
## #   Topic_40 <dbl>, Topic_41 <dbl>, Topic_42 <dbl>, Topic_43 <dbl>,
## #   Topic_44 <dbl>, Topic_45 <dbl>, Topic_46 <dbl>, Topic_47 <dbl>,
## #   Topic_48 <dbl>, Topic_49 <dbl>, Topic_5 <dbl>, Topic_50 <dbl>,
## #   Topic_51 <dbl>, Topic_52 <dbl>, Topic_53 <dbl>, Topic_54 <dbl>,
## #   Topic_55 <dbl>, Topic_56 <dbl>, Topic_57 <dbl>, Topic_58 <dbl>,
## #   Topic_59 <dbl>, Topic_6 <dbl>, Topic_60 <dbl>, Topic_61 <dbl>,
```

```
## #   Topic_62 <dbl>, Topic_63 <dbl>, Topic_64 <dbl>, Topic_65 <dbl>,
## #   Topic_7 <dbl>, Topic_8 <dbl>, Topic_9 <dbl>, fold <int>, Y_hat <dbl>,
## #   error <dbl>, error_hat <dbl>, width <dbl>, border_low <dbl>,
## #   border_high <dbl>, hit <lgl>
```

5 Figures