# Week 9: Function specific switching

- Idea: Measure the performance of the static algorithm selectors on instances 1 to 5
- I used a 4-fold cross validation where I trained the selectors on ¾ of runs, and then let them predict the best algorithm for the remaining quarter.
- For each function, I set the switching point as the budget for which the static selector at that budget performed best on that function (lowest sum of precisions across all runs on that function)
- I then trained random forests, one for each possible switching budget, that predict whether or not to switch for a run (so a binary prediction here)

# Week 9: Function specific switching

- In a first attempt, I set the switch decision to true for a function and a budget, only if that budget is the right budget for the function
- This resulted in poor performance, because each run for which the right budget was not detected, then continued without switching, which is basically always a bad decision
- So, I set the switch decision to true for a function and a budget, if that budget is greater or equal than the right budget for that function. (So that if a run is not detected to switch at the right budget, it will switch somewhere behind that)
- This resulted in good performance

# Results if we consider multiples of 50 as switching points

selector_optimal_switching: Precision of the selector that, for each fid, switches at the best static switching point for that fid (according to the algorithm predictions on the training runs)

| Method | Ratio |
|---|---|
| selector | 0.6914739331516234 |
| selector_optimal_switching | 0.6937242813091179 |
| static_B50 | 0.7342292114590188 |
| static_B200 | 0.7834688934562055 |
| static_B100 | 0.8096604126452549 |
| static_B150 | 0.8279748194510756 |
| static_B350 | 0.8295645201063693 |
| static_B450 | 0.8315831727495465 |
| static_B300 | 0.833793375248887 |
| static_B400 | 0.8454845500999881 |
| static_B250 | 0.8521377125549351 |
| static_B500 | 0.8646264151484486 |
| static_B550 | 0.8651682121985461 |
| static_B600 | 0.8680715726930405 |
| static_B650 | 0.8727674677814952 |
| static_B700 | 0.9691203768199774 |
| static_B750 | 1.170709233204784 |
| static_B800 | 1.2944068941955356 |
| static_B850 | 1.612240193937837 |
| static_B900 | 1.9356077011386117 |
| static_B950 | 2.5804227966401223 |
| static_B1000 | 3.9009662685339572 |

# Results for multiples of 50 and multiples of 8 lower than 100

| Method | Ratio |
|---|---|
| selector | 0.7348407859659998 |
| selector_optimal_switching | 0.7414546343743612 |
| static_B80 | 0.8343698876143243 |
| static_B56 | 0.8431062571644096 |
| static_B64 | 0.865747418437369 |
| static_B24 | 0.8695766953339663 |
| static_B40 | 0.874061958394088 |
| static_B96 | 0.8749348244632318 |
| static_B200 | 0.8864525814801185 |
| static_B100 | 0.9095093121298923 |
| static_B48 | 0.9111641348804176 |
| static_B150 | 0.9256317196040164 |
| static_B350 | 0.9270311535031466 |
| static_B450 | 0.9288081993450942 |
| static_B32 | 0.9297976509890551 |
| static_B72 | 0.9301458725592493 |
| static_B300 | 0.9307538689849849 |
| static_B400 | 0.9410457603249096 |
| static_B250 | 0.9469026246627765 |
| static_B88 | 0.9556409676800052 |
| static_B500 | 0.9578965899148633 |
| static_B550 | 0.9583735408149151 |
| static_B600 | 0.9609294063383146 |
| static_B650 | 0.9650632630815067 |
| static_B16 | 0.9933172712163364 |
| static_B700 | 1.049883966110878 |
| static_B750 | 1.227345224853125 |
| static_B800 | 1.3362378641416175 |
| static_B8 | 1.3913457921804038 |
| static_B850 | 1.6160305989880546 |
| static_B900 | 1.9006951677212154 |
| static_B950 | 2.4683341759274477 |
| static_B1000 | 3.63082555044471 |

# Evaluation on new instances

- I also wanted to see if this works if we use runs on instances 6 and 7 (20 each) as a test set. Once again, I considered both sets of switching points
- The performance is worse here. Maybe this is because the distributions of training and test set are too different?

| Method | Ratio |
|---|---|
| selector | 0.7397463435645291 |
| static_B64 | 0.783110528315716 |
| static_B80 | 0.7991784183080536 |
| static_B96 | 0.8011234209716904 |
| static_B56 | 0.8052528171186433 |
| static_B48 | 0.8091478061854296 |
| selector_optimal_switching | 0.8201803586687644 |
| static_B100 | 0.8340053853588267 |
| static_B72 | 0.8350493625064949 |
| static_B550 | 0.8507966151371419 |
| static_B300 | 0.8522574095492805 |
| static_B400 | 0.8527850943443569 |
| static_B350 | 0.857926650631531 |
| static_B250 | 0.8623110386200014 |
| static_B500 | 0.8793981739119423 |
| static_B150 | 0.881782488942987 |
| static_B600 | 0.8849761676564104 |
| static_B450 | 0.8905819890916795 |
| static_B650 | 0.8915562283902 |
| static_B200 | 0.900379391354849 |
| static_B88 | 0.9070488066040253 |
| static_B24 | 0.9505310751659515 |
| static_B700 | 0.9615915740558716 |
| static_B32 | 0.9655715603363839 |
| static_B16 | 1.011701664513621 |
| static_B40 | 1.0258049077785734 |
| static_B750 | 1.1243501419530186 |
| static_B8 | 1.1955308516283178 |
| static_B800 | 1.2689075171966206 |
| static_B850 | 1.6472226745221685 |
| static_B900 | 1.9641426220843177 |
| static_B950 | 3.2024631000855757 |
| static_B1000 | 8.075054376573444 |

| Method | Ratio |
|---|---|
| selector_optimal_switching | 0.7997233486711641 |
| static_B50 | 0.8052528171186433 |
| selector | 0.8082308838341555 |
| static_B100 | 0.8340053853588267 |
| static_B550 | 0.8507966151371419 |
| static_B300 | 0.8522574095492805 |
| static_B400 | 0.8527850943443569 |
| static_B350 | 0.857926650631531 |
| static_B250 | 0.8623110386200014 |
| static_B500 | 0.8793981739119423 |
| static_B150 | 0.881782488942987 |
| static_B600 | 0.8849761676564104 |
| static_B450 | 0.8905819890916795 |
| static_B650 | 0.8915562283902 |
| static_B200 | 0.900379391354849 |
| static_B700 | 0.9615915740558716 |
| static_B750 | 1.1243501419530186 |
| static_B800 | 1.2689075171966206 |
| static_B850 | 1.6472226745221685 |
| static_B900 | 1.9641426220843177 |
| static_B950 | 3.2024631000855757 |
| static_B1000 | 8.075054376573444 |

# Questions

- Is the switching selection done right? I think we could probably improve here. Currently, around 80% of runs switch at the right switching point. We need a way to handle the remaining runs.
- I also tried to tune the switching models (according to F1 score), but this did not improve the performance. Should I tune them according to a different metric?
- The performance of the static selectors on the training and test data often does not really match. I think we need more data (so more runs per instance) to really understand this. Currently, the performance of a static selector for a certain fid depends on only a few (un)lucky algorithm choices