

RQ1: Can we quantify interest of TD at the functional level? How much is the interest? (Version 5)

Yasutaka Kamei

Feb 13th, 2016

What's new in the version 5?

- Add histograms

What's new in the version 4?

- We used the new dataset that solves one bug that is fixed by Everton.

Data Load

```
setwd("/Users/kamei/Research/techdebt/msr16_td_interest/")
source("./r_scripts/data_read.r")
```

Data Summary

- (Step 1) choose one of duplicated method and version name
- (Step 2) only use technical debt including metrics

```
nrow(data)
```

```
## [1] 837
```

```
apply(data.s1[,c("version_name", "CountInput_v1", "CountInput_v2")], 2, function(x){sum(x == -1) })
```

```
## version_name CountInput_v1 CountInput_v2
##           8           221           94
```

Observation

- The number of methods that cannot be linked between Everton's data and metrics data
 - 171 => 221 (introducing)
 - 101 => 94 (being found as last version)

(Step 3) use technical debt including non 0 for division

CountLine

```
summary(data.CountLine.all$Project)
```

```
##      apache-ant apache-jmeter      jruby  
##           71           181           236
```

```
summary(data.CountLine.positive$Project)
```

```
##      apache-ant apache-jmeter      jruby  
##           27           80           77
```

```
summary(data.CountLine.negative$Project)
```

```
##      apache-ant apache-jmeter      jruby  
##           20           25           59
```

```
summary(data.CountLine.positive$Project) / summary(data.CountLine.all$Project) * 100
```

```
##      apache-ant apache-jmeter      jruby  
##      38.02817      44.19890      32.62712
```

```
summary(data.CountLine.negative$Project) / summary(data.CountLine.all$Project) * 100
```

```
##      apache-ant apache-jmeter      jruby  
##      28.16901      13.81215      25.00000
```

CountInput

```
summary(data.CountInput.all$Project)
```

```
##      apache-ant apache-jmeter      jruby  
##           68           161           231
```

```
summary(data.CountInput.positive$Project)
```

```
##      apache-ant apache-jmeter      jruby  
##           21           68           70
```

```
summary(data.CountInput.negative$Project)
```

```
##      apache-ant apache-jmeter      jruby  
##           13           13           37
```

```
summary(data.CountInput.positive$Project) / summary(data.CountInput.all$Project) * 100
```

```
##      apache-ant apache-jmeter      jruby
##      30.88235    42.23602    30.30303
```

```
summary(data.CountInput.negative$Project) / summary(data.CountInput.all$Project) * 100
```

```
##      apache-ant apache-jmeter      jruby
##      19.117647    8.074534    16.017316
```

Observation

- The number of all methods is 837
 - (s1) 754
 - (s2) 488
- We use 71, 181, and 236 methods including technical debt.
 - The data set we used had 67 (ant), 169(jmeter) and 268(jruby) technical debt.
- 32.6%-44.2% of technical debt has positive interest.
- 13.8%-28.7% of technical debt has negative interest.

CountLine

```
# interest of CountLine (LOC)
fc <- factor(data.CountLine.all$Project)
interest <- data.CountLine.all$interest
tapply(interest, fc, summary)
```

```
## $`apache-ant`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -85.0000 -4.2910   0.0000  -0.8538  6.9050  75.0000
##
## $`apache-jmeter`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  -66.04    0.00    0.00   53.63   13.89 6667.00
##
## $jruby
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -95.8300 -0.4032   0.0000   6.2810   7.2440 362.5000
```

```
fc <- factor(data.CountLine.positive$Project)
interest <- data.CountLine.positive$interest
tapply(interest, fc, summary)
```

```
## $`apache-ant`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    1.370    6.155   11.110   18.400   25.400   75.000
```

```
##
## $`apache-jmeter`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      1.562   6.920   18.010  126.300   50.000 6667.000
##
## $jruby
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      1.266   7.692   20.690   41.100   40.000 362.500
```

```
fc <- factor(data.CountLine.negative$Project)
interest <- data.CountLine.negative$interest
tapply(interest, fc, summary)
```

```
## $`apache-ant`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     -85.000 -39.800 -23.160 -27.870   -6.561   -1.538
##
## $`apache-jmeter`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     -66.040 -17.240 -12.500 -15.740   -5.814   -2.000
##
## $jruby
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     -95.830 -44.170 -16.670 -28.510   -9.167   -1.613
```

CountInput

```
# CountInput
fc <- factor(data.CountInput.all$Project)
interest <- data.CountInput.all$interest
tapply(interest, fc, summary)
```

```
## $`apache-ant`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     -69.23   0.00   0.00   50.20   12.18 2700.00
##
## $`apache-jmeter`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     -66.67   0.00   0.00   23.03   20.00  900.00
##
## $jruby
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     -68.75   0.00   0.00   21.70   14.29  450.00
```

```
fc <- factor(data.CountInput.positive$Project)
interest <- data.CountInput.positive$interest
tapply(interest, fc, summary)
```

```
## $`apache-ant`
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
```

```
##      5.263    20.000    33.330   180.400   100.000  2700.000
##
## $`apache-jmeter`
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
##      5.556  12.380  25.000   60.470   50.000  900.000
##
## $jruby
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
##      7.143  17.500  33.330   87.880  100.000  450.000
```

```
fc <- factor(data.CountInput.negative$Project)
interest <- data.CountInput.negative$interest
tapply(interest, fc, summary)
```

```
## $`apache-ant`
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
##     -69.230 -50.000 -25.000  -28.910   -8.333   -8.333
##
## $`apache-jmeter`
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
##     -66.67  -37.50  -29.63  -31.06  -18.18  -10.00
##
## $jruby
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
##     -68.750 -50.000 -25.000  -30.810  -14.290   -6.667
```

Plot

```
library(reshape2)
library(ggplot2)

if(0){
  idx <- data.CountLine.positive$Project == "apache-ant"
  a1 <- data.frame(Interest=data.CountLine.positive[idx,"interest"])
  g = ggplot(a1, aes(x=Interest, y=..density.., fill=T), lims(x = c(0,400)))
  g = g + geom_density(alpha = 0.5) + xlim(0, 400) + ylim(0,0.04) + guides(fill=FALSE)
  print(g)
  ggsave(file = "./tex/figures/rq1-ant.pdf", plot = g, width = 8.09, height = 5)

  idx <- data.CountLine.positive$Project == "apache-jmeter"
  a2 <- data.frame(Interest=data.CountLine.positive[idx,"interest"])
  g = ggplot(a2, aes(x=Interest, y=..density.., fill=T, lims(x = c(0,400))))
  g = g + geom_density(alpha = 0.5) + xlim(0, 400) + ylim(0,0.04) + guides(fill=FALSE)
  print(g)
  ggsave(file = "./tex/figures/rq1-jmeter.pdf", plot = g, width = 8.09, height = 5)

  idx <- data.CountLine.positive$Project == "jruby"
  a3 <- data.frame(Interest=data.CountLine.positive[idx,"interest"])
  g = ggplot(a3, aes(x=Interest, y=..density.., fill=T), lims(x = c(0,400)))
  g = g + geom_density(alpha = 0.5) + xlim(0, 400) + ylim(0,0.04) + guides(fill=FALSE)
  print(g)
```

```

ggsave(file = "./tex/figures/rq1-jruby.pdf", plot = g, width = 8.09, height = 5)
}

if(0){
idx <- data.CountInput.all$Project == "apache-ant"
a1 <- data.frame(Interest=data.CountInput.positive[idx,"interest"])
g = ggplot(a1, aes(x=Interest, y=..density.., fill=T), lims(x = c(0,400)))
g = g + geom_density(alpha = 0.5) + xlim(0, 400) + ylim(0,0.04) + guides(fill=FALSE)
print(g)
ggsave(file = "./tex/figures/rq1-ant-fanin.pdf", plot = g, width = 8.09, height = 5)

idx <- data.CountInput.all$Project == "apache-jmeter"
a2 <- data.frame(Interest=data.CountInput.positive[idx,"interest"])
g = ggplot(a2, aes(x=Interest, y=..density.., fill=T), lims(x = c(0,400)))
g = g + geom_density(alpha = 0.5) + xlim(0, 400) + ylim(0,0.04) + guides(fill=FALSE)
print(g)
ggsave(file = "./tex/figures/rq1-jmeter-fanin.pdf", plot = g, width = 8.09, height = 5)

idx <- data.CountInput.all$Project == "jruby"
a3 <- data.frame(Interest=data.CountInput.positive[idx,"interest"])
g = ggplot(a3, aes(x=Interest, y=..density.., fill=T), lims(x = c(0,400)))
g = g + geom_density(alpha = 0.5) + xlim(0, 400) + ylim(0,0.04) + guides(fill=FALSE)
print(g)
ggsave(file = "./tex/figures/rq1-jruby-fanin.pdf", plot = g, width = 8.09, height = 5)
}

```