

Matlab TTL performance

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load required packages

Load all packages required for the analysis. If these packages are not available, install them on the fly with a `install.packages(<packagesname>)` call.

```
Pckglst = c("ezknitr", "ggplot2", "plyr")
for(cPckg in Pckglst){
  if(!require(cPckg , character.only=TRUE)){
    install.packages(cPckg)
    library(cPckg , character.only = TRUE)
  }
}
```

get data

helper functions

```
# read tektronix file
ReadTektronix = function(flnm=NA){
  dt = read.csv(flnm, header=FALSE, colClasses=c("NULL", "NULL", "NULL", NA, NA))

  tvec = as.numeric(dt$V4) * 1000
  vvec = as.numeric(dt$V5)

  na_pos = vvec < -8
  bvec = as.numeric(vvec > mean(vvec[!na_pos]))
  bvec[na_pos] = NA

  dvec = c(0, diff(bvec))

  pos = which(dvec != 0)

  On = c()
  Off = c()

  for(p in 1:(length(pos)-1)){
    if(!any(is.na(dvec[pos[p]:pos[p+1]-1]))){
      itv = tvec[pos[p+1]-1] - tvec[pos[p]]
      if(dvec[pos[p]] == 1){ On = c(On, itv) }
      if(dvec[pos[p]] == -1){ Off = c(Off, itv) }
    }
  }
  return(list(On=On, Off=Off))
}

# combine all files
```

```

ReadAllFiles = function(fllst=NA, BoardLbl=NA){

  for(i in 1:length(fllst)){
    tmpTTL = ReadTektronix(fllst[i])

    if(i==1){ TTL = tmpTTL }
    if(i!=1){ TTL = Map(c, TTL, tmpTTL) }
  }

  ITV   = c(TTL$On, TTL$Off)
  State = c(rep('ON', length(TTL$On)), rep('OFF', length(TTL$Off)))
  Board = rep(BoardLbl, length(State))

  return(data.frame(Board, State, ITV))
}

flset = 0:11

# Arduino Uno
fllst = sprintf('data/repeated_50on_50off/Arduino_uno/ALL%.4d/F%.4dCH1.CSV',
               flset, flset)
uno_df = ReadAllFiles(fllst, BoardLbl='Uno')

# Arduino Due
fllst = sprintf('data/repeated_50on_50off/Arduino_due/ALL%.4d/F%.4dCH1.CSV',
               flset, flset)
due_df = ReadAllFiles(fllst, BoardLbl='Due')

# Sunfounder Mega
fllst = sprintf('data/repeated_50on_50off/Sunfounder_mega/ALL%.4d/F%.4dCH1.CSV',
               flset, flset)
mega_df = ReadAllFiles(fllst, BoardLbl='Mega')

# STEMtera
fllst = sprintf('data/repeated_50on_50off/STEMtera/ALL%.4d/F%.4dCH1.CSV',
               flset, flset)
STEM_df = ReadAllFiles(fllst, BoardLbl='STEMtera')

All_dt = rbind(uno_df, due_df)
All_dt = rbind(All_dt, mega_df)
All_dt = rbind(All_dt, STEM_df)

All_dt$ITV_diff = All_dt$ITV - 50

ON_dt  = droplevels(subset(All_dt, All_dt$State == 'ON'))
OFF_dt = droplevels(subset(All_dt, All_dt$State == 'OFF'))

```

High state time difference

```

mu <- ddply(ON_dt, "Board", summarise, grp.mean=mean(ITV_diff, na.rm=TRUE))

ggplot(ON_dt, aes(x=ITV_diff, color=Board, fill=Board))

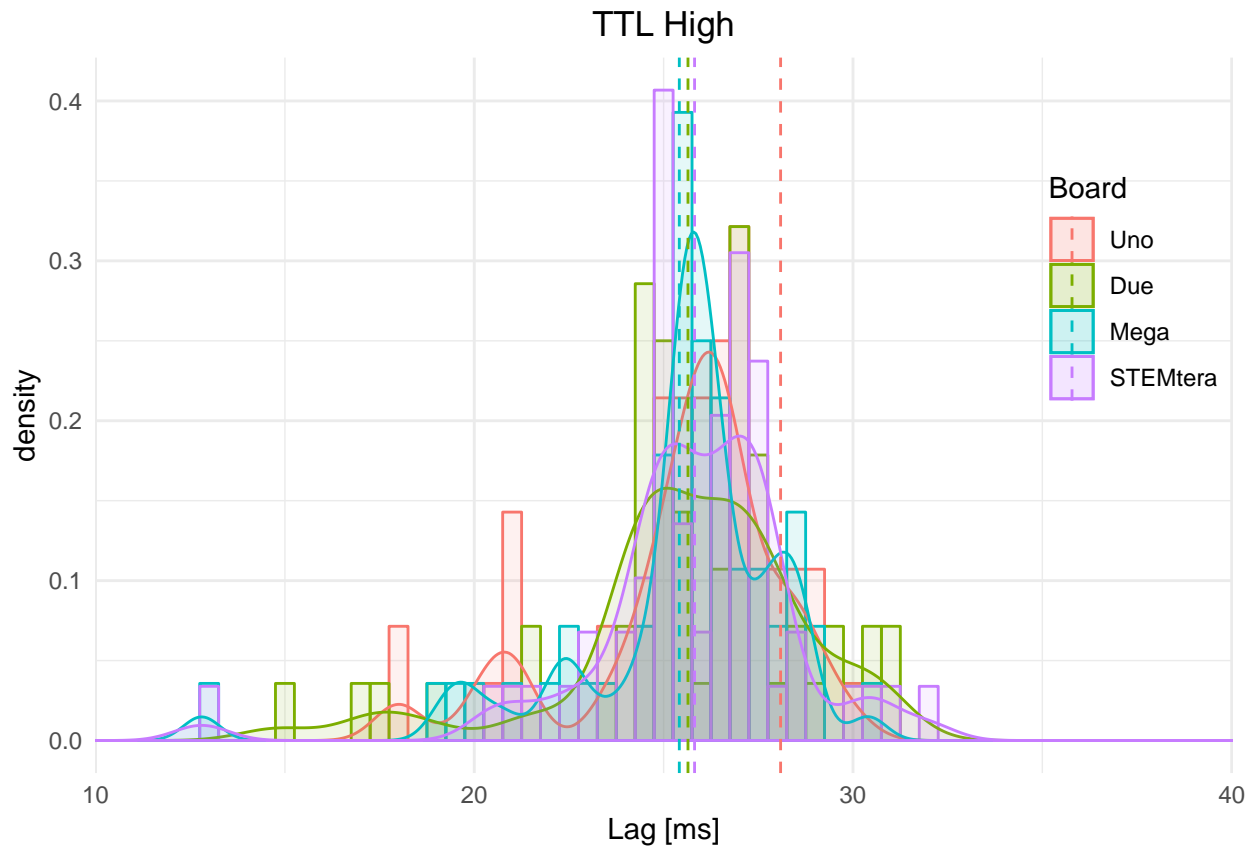
```

+

```

theme_minimal() + ggtitle('TTL High') + ylab('density') + xlab('Lag [ms]') +
theme(plot.title=element_text(hjust=0.5)) + theme(panel.border=element_blank()) +
geom_histogram(aes(y=..density..), alpha=0.1, position="identity", binwidth=0.5) +
scale_x_continuous(limits=c(10, 40), expand=c(0, 0.01)) +
geom_density(aes(x=ITV_diff, fill=Board), alpha=0.1) +
geom_vline(data=mu, aes(xintercept=grp.mean, color=Board), linetype="dashed") +
theme(legend.justification=c(1, 0), legend.position=c(1, 0.5))

```



```
print(mu)
```

```

##      Board grp.mean
## 1      Uno 28.08814
## 2      Due 25.64286
## 3     Mega 25.41429
## 4 STEMtera 25.81695

```

Low state time difference

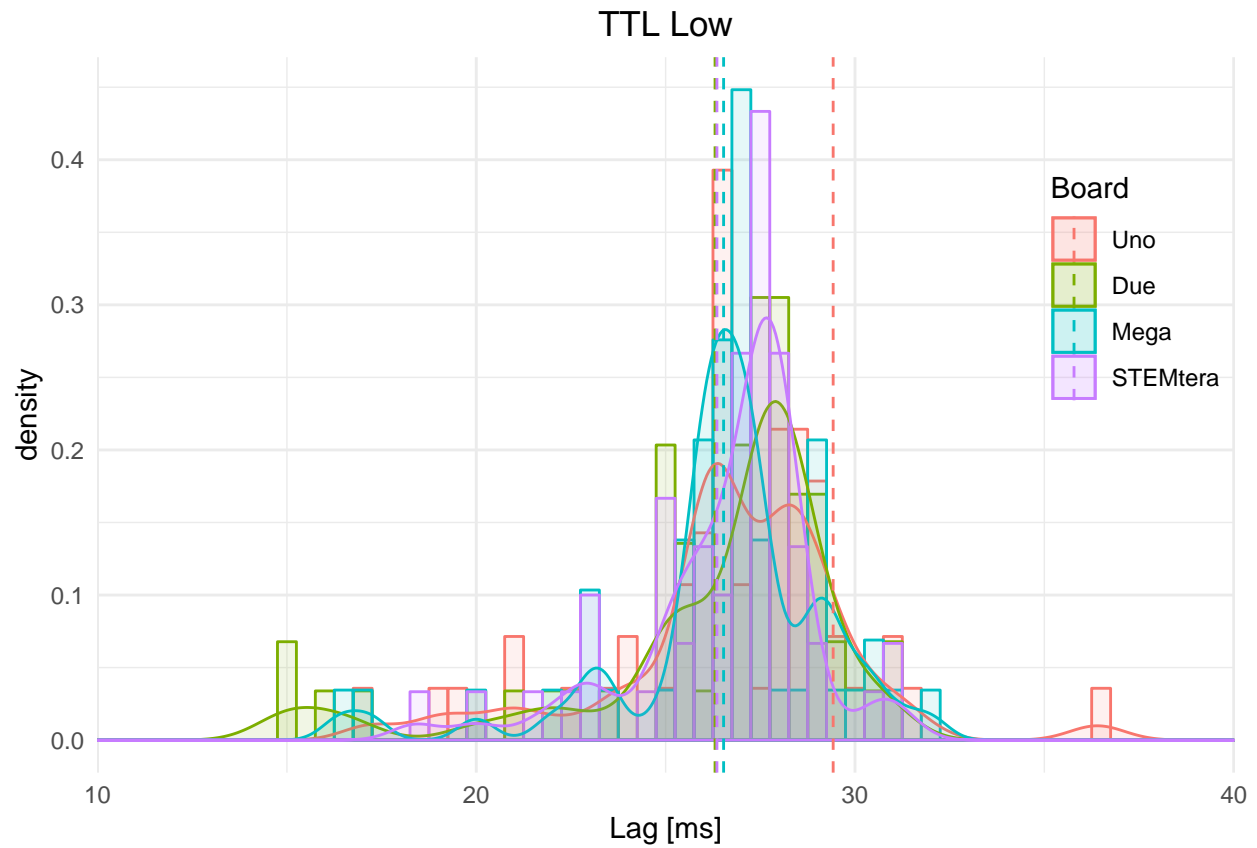
```

mu <- ddply(OFF_dt, "Board", summarise, grp.mean=mean(ITV_diff, na.rm=TRUE))

ggplot(OFF_dt, aes(x=ITV_diff, color=Board, fill=Board)) +
  theme_minimal() + ggtitle('TTL Low') + ylab('density') + xlab('Lag [ms]') +
  theme(plot.title=element_text(hjust=0.5)) + theme(panel.border=element_blank()) +
  geom_histogram(aes(y=..density..), alpha=0.1, position="identity", binwidth=0.5) +
  scale_x_continuous(limits=c(10, 40), expand=c(0, 0.01)) +
  geom_density(aes(x=ITV_diff, fill=Board), alpha=0.1)

```

```
geom_vline(data=mu, aes(xintercept=grp.mean, color=Board), linetype="dashed") +  
theme(legend.justification=c(1, 0), legend.position=c(1, 0.5))
```



```
print(mu)
```

```
##      Board grp.mean  
## 1      Uno 29.42373  
## 2      Due 26.30508  
## 3     Mega 26.53103  
## 4 STEMtera 26.35410
```