StatisticsForMachineVision

Libraries

```
library(readxl)
library(PMCMRplus)
```

```
## Warning: package 'PMCMRplus' was built under R version 4.1.2
```

Import data

Firs we import our data.

```
data <- read_excel("metrics.xlsx")
data$test <- as.factor(data$test)
data$approach <- as.factor(data$approach)
summary(data)
```

```
##       test            approach     accuracy            mae
##  1      : 2   mlearning  :11   Min.   :0.0000   Min.   :0.2380
##  2      : 2   traditional:11   1st Qu.:0.5050   1st Qu.:0.3820
##  3      : 2                    Median :0.6190   Median :0.6240
##  4      : 2                    Mean   :0.6055   Mean   :0.5717
##  5      : 2                    3rd Qu.:0.7440   3rd Qu.:0.7450
##  6      : 2                    Max.   :0.9000   Max.   :1.0000
##  (Other):10
##       time
##  Min.   :0.02600
##  1st Qu.:0.07825
##  Median :0.15750
##  Mean   :0.22864
##  3rd Qu.:0.24400
##  Max.   :1.50000
##
```

Normality tests

We carry normality tests. Shapiro Wilk's test was used due to the small sample size. The null hypothesis for this test is that the sample distribution is normal.

```
accuracy <- shapiro.test(data$accuracy)
mae <- shapiro.test(data$mae)
time <- shapiro.test(data$time)

print(accuracy)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  data$accuracy
## W = 0.92099, p-value = 0.0797
```

```
print(mae)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  data$mae
## W = 0.90693, p-value = 0.041
```

```
print(time)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  data$time
## W = 0.57222, p-value = 6.759e-07
```

t-test and Wilcoxon

We apply t-test for accuracy as it comes from a normal distribution, and Wilcoxon for Mean Absolute Error (MAE) and Execution Time (time) as they rejected the null hypothesis.

```
t_accuracy <- t.test(data$accuracy ~ data$approach)
wilcox_mae <- wilcox.test(data$mae ~ data$approach )
```

```
## Warning in wilcox.test.default(x = c(0.7, 0.75, 0.7, 0.75, 0.71, 0.75, 0.7, :
## cannot compute exact p-value with ties
```

```
wilcox_time <- wilcox.test(data$time ~ data$approach )

print(t_accuracy)
```

```
##
##  Welch Two Sample t-test
##
## data:  data$accuracy by data$approach
## t = -0.10693, df = 12.197, p-value = 0.9166
## alternative hypothesis: true difference in means between group mlearning and group tr
aditional is not equal to 0
## 95 percent confidence interval:
##  -0.2002648  0.1814963
## sample estimates:
##   mean in group mlearning mean in group traditional
##                 0.6007975                 0.6101818
```

```
print(wilcox_mae)
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  data$mae by data$approach
## W = 121, p-value = 7.282e-05
## alternative hypothesis: true location shift is not equal to 0
```

```
print(wilcox_time)
```

```
##
##  Wilcoxon rank sum exact test
##
## data:  data$time by data$approach
## W = 40, p-value = 0.1932
## alternative hypothesis: true location shift is not equal to 0
```

Summary

According to the above:

- There is no difference in the Accuracy between the traditional and the machine learning approach (i.e., the t-test failed to reject the null hypothesis).
- There is significant difference in the Mean Absolute Error (MAE) between the traditional and the machine learning approach (i.e., the Wilcoxon test rejected the null hypothesis).
- There is no difference in the Execution Time between the traditional and the machine learning approach (i.e., the Wilcoxon test failed to reject the null hypothesis).