RBCs

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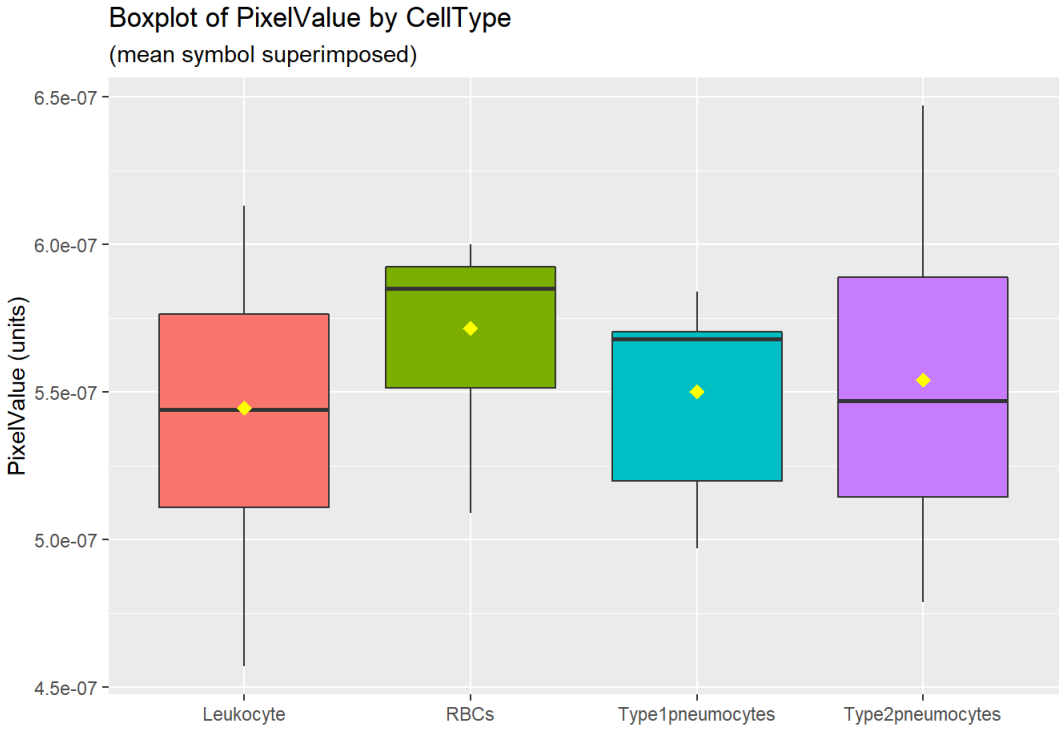
The aims of the analysis is to investigate which Pixel Values, on average, differ between the Cell Types (Leukocytes, RBCs, T1, T2).

```
##    CellType PixelValue nPixelValue
## 1 Leukocyte   4.57e-07         457
## 2 Leukocyte   4.80e-07         480
## 3 Leukocyte   5.16e-07         516
## 4 Leukocyte   5.06e-07         506
## 5 Leukocyte   4.96e-07         496
## 6 Leukocyte   5.79e-07         579
```

Pixel Value / 10^-9

	Leukocyte (N=15)	RBCs (N=15)	Type1pneumocytes (N=15)	Type2pneumocytes (N=15)	Overall (N=60)
nPixelValue					
Mean (SD)	545 (46.5)	572 (27.7)	550 (30.6)	554 (50.3)	555 (40.3)
Median [Min, Max]	544 [457, 613]	585 [509, 600]	568 [497, 584]	547 [479, 647]	568 [457, 647]



SUBJECTIVE IMPRESSIONS - NULL AND ALTERNATIVE HYPOTHESIS

Null Hypothesis H0 = The population PixelValue is equal in the population between RBCs and Leukocytes/t1pneumocytes/t2pneumocytes.

Alternative Hypothesis H1 = The population PixelValue is NOT equal in the population between RBCs and Leukocytes/t1pneumocytes/t2pneumocytes.

```
##
##  Pairwise comparisons using t tests with pooled SD
##
## data:  lungtissue.df$PixelValue and lungtissue.df$CellType
##
##                  Leukocyte RBCs Type1pneumocytes
## RBCs             0.07      -    -
## Type1pneumocytes 0.71      0.15 -
## Type2pneumocytes 0.52      0.24 0.79
##
## P value adjustment method: none
```

To determine which groups have different population PixelValues, a pairwise comparison using the pairwise t test was done (no correction method). No cell type comparison has a P value less than 0.05. One can then conclude that there is no significant difference, on average, of the PixelValue between each of the pairs.

```
##     CellType PixelValue nPixelValue
## 1  Leukocyte   4.57e-07        457
## 2  Leukocyte   4.80e-07        480
## 3  Leukocyte   5.16e-07        516
## 4  Leukocyte   5.06e-07        506
## 5  Leukocyte   4.96e-07        496
## 6  Leukocyte   5.79e-07        579
## 7  Leukocyte   5.36e-07        536
## 8  Leukocyte   5.44e-07        544
## 9  Leukocyte   6.05e-07        605
## 10 Leukocyte   5.89e-07        589
## 11 Leukocyte   6.13e-07        613
## 12 Leukocyte   5.64e-07        564
## 13 Leukocyte   5.74e-07        574
## 14 Leukocyte   5.74e-07        574
## 15 Leukocyte   5.38e-07        538
## 16      RBCs   5.37e-07        537
## 17      RBCs   5.38e-07        538
## 18      RBCs   5.58e-07        558
## 19      RBCs   5.09e-07        509
## 20      RBCs   5.45e-07        545
## 21      RBCs   5.89e-07        589
## 22      RBCs   5.94e-07        594
## 23      RBCs   5.85e-07        585
## 24      RBCs   5.92e-07        592
## 25      RBCs   5.97e-07        597
## 26      RBCs   5.89e-07        589
## 27      RBCs   5.77e-07        577
## 28      RBCs   5.93e-07        593
## 29      RBCs   5.72e-07        572
## 30      RBCs   6.00e-07        600
```

```
##            CellType PixelValue nPixelValue
## 1              RBCs   5.37e-07        537
## 2              RBCs   5.38e-07        538
## 3              RBCs   5.58e-07        558
## 4              RBCs   5.09e-07        509
## 5              RBCs   5.45e-07        545
## 6              RBCs   5.89e-07        589
## 7              RBCs   5.94e-07        594
## 8              RBCs   5.85e-07        585
## 9              RBCs   5.92e-07        592
## 10             RBCs   5.97e-07        597
## 11             RBCs   5.89e-07        589
## 12             RBCs   5.77e-07        577
## 13             RBCs   5.93e-07        593
## 14             RBCs   5.72e-07        572
## 15             RBCs   6.00e-07        600
## 16 Type1pneumocytes   4.97e-07        497
## 17 Type1pneumocytes   5.12e-07        512
## 18 Type1pneumocytes   5.01e-07        501
## 19 Type1pneumocytes   5.16e-07        516
## 20 Type1pneumocytes   5.24e-07        524
## 21 Type1pneumocytes   5.76e-07        576
## 22 Type1pneumocytes   5.55e-07        555
## 23 Type1pneumocytes   5.70e-07        570
## 24 Type1pneumocytes   5.84e-07        584
## 25 Type1pneumocytes   5.71e-07        571
## 26 Type1pneumocytes   5.67e-07        567
## 27 Type1pneumocytes   5.68e-07        568
## 28 Type1pneumocytes   5.69e-07        569
## 29 Type1pneumocytes   5.74e-07        574
## 30 Type1pneumocytes   5.69e-07        569
```

```
##           CellType PixelValue nPixelValue
## 1             RBCs   5.37e-07        537
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## 5             RBCs   5.45e-07        545
## 6             RBCs   5.89e-07        589
## 7             RBCs   5.94e-07        594
## 8             RBCs   5.85e-07        585
## 9             RBCs   5.92e-07        592
## 10            RBCs   5.97e-07        597
## 11            RBCs   5.89e-07        589
## 12            RBCs   5.77e-07        577
## 13            RBCs   5.93e-07        593
## 14            RBCs   5.72e-07        572
## 15            RBCs   6.00e-07        600
## 16 Type2pneumocytes   5.13e-07        513
## 17 Type2pneumocytes   4.92e-07        492
## 18 Type2pneumocytes   4.79e-07        479
## 19 Type2pneumocytes   5.16e-07        516
## 20 Type2pneumocytes   4.95e-07        495
## 21 Type2pneumocytes   5.46e-07        546
## 22 Type2pneumocytes   5.97e-07        597
## 23 Type2pneumocytes   5.45e-07        545
## 24 Type2pneumocytes   6.47e-07        647
## 25 Type2pneumocytes   6.31e-07        631
## 26 Type2pneumocytes   5.57e-07        557
## 27 Type2pneumocytes   5.91e-07        591
## 28 Type2pneumocytes   5.87e-07        587
## 29 Type2pneumocytes   5.70e-07        570
## 30 Type2pneumocytes   5.47e-07        547
```

```
##           CellType PixelValue nPixelValue
## 1  Type1pneumocytes   4.97e-07        497
## 2  Type1pneumocytes   5.12e-07        512
## 3  Type1pneumocytes   5.01e-07        501
## 4  Type1pneumocytes   5.16e-07        516
## 5  Type1pneumocytes   5.24e-07        524
## 6  Type1pneumocytes   5.76e-07        576
## 7  Type1pneumocytes   5.55e-07        555
## 8  Type1pneumocytes   5.70e-07        570
## 9  Type1pneumocytes   5.84e-07        584
## 10 Type1pneumocytes   5.71e-07        571
## 11 Type1pneumocytes   5.67e-07        567
## 12 Type1pneumocytes   5.68e-07        568
## 13 Type1pneumocytes   5.69e-07        569
## 14 Type1pneumocytes   5.74e-07        574
## 15 Type1pneumocytes   5.69e-07        569
## 16 Type2pneumocytes   5.13e-07        513
## 17 Type2pneumocytes   4.92e-07        492
## 18 Type2pneumocytes   4.79e-07        479
## 19 Type2pneumocytes   5.16e-07        516
## 20 Type2pneumocytes   4.95e-07        495
## 21 Type2pneumocytes   5.46e-07        546
## 22 Type2pneumocytes   5.97e-07        597
## 23 Type2pneumocytes   5.45e-07        545
## 24 Type2pneumocytes   6.47e-07        647
## 25 Type2pneumocytes   6.31e-07        631
## 26 Type2pneumocytes   5.57e-07        557
## 27 Type2pneumocytes   5.91e-07        591
## 28 Type2pneumocytes   5.87e-07        587
## 29 Type2pneumocytes   5.70e-07        570
## 30 Type2pneumocytes   5.47e-07        547
```

T1 vs T2

```
## # A tibble: 1 x 7
##   statistic  t_df p_value alternative estimate      lower_ci     upper_ci
##       <dbl> <dbl>   <dbl> <chr>          <dbl>         <dbl>        <dbl>
## 1    -0.263  23.1   0.795 two.sided   -4.00e-9 -0.0000000354 0.0000000274
```

vs LEUKOCYTES

```
## # A tibble: 1 x 7
##   statistic  t_df p_value alternative     estimate lower_ci     upper_ci
##       <dbl> <dbl>   <dbl> <chr>              <dbl>    <dbl>        <dbl>
## 1      1.93  22.9  0.0664 two.sided   0.0000000269 -1.98e-9 0.0000000558
```

A two-tailed student's t-test was conducted with a 95% confidence interval.The p-value (0.066) is greate than 0.05 and the null hypothesis is not rejected. Furthermore, there is a 95% confidence that the difference between the two population means is between -1.98e-08 and 5.58e-08. There is no evidence of a difference between the the RBCs and leukocytes.The average difference between the two cell types is not statistically significant.

RBCs vs T1

```
## # A tibble: 1 x 7
##   statistic  t_df p_value alternative     estimate  lower_ci     upper_ci
##       <dbl> <dbl>   <dbl> <chr>              <dbl>     <dbl>        <dbl>
## 1      2.01  27.7  0.0539 two.sided   0.0000000215 -3.83e-10 0.0000000433
```

The p-value (0.054) is greater than 0.05 and the null hypothesis is not rejected. Furthermore, there is a 95% confidence that the difference between the two population means is between -3.83e-10 and 4.33e-08. Since the range is not exclusive to zero, there is no evidence, on average, of a difference between the RBCs and type1pneumocytes.The average difference between the two cell types is not statistically significant.

RBCs vs T2

```
## # A tibble: 1 x 7
##   statistic  t_df p_value alternative     estimate      lower_ci     upper_ci
##       <dbl> <dbl>   <dbl> <chr>              <dbl>         <dbl>        <dbl>
## 1      1.18  21.8   0.252 two.sided   0.0000000175 -0.0000000133 0.0000000482
```

The p-value (0.25) is greater than 0.05 and the null hypothesis is not rejected. Furthermore, there is a 95% confidence that the difference between the two population means is between -1.33e-08 and 4.82e-08. SSince the range is not exclusive to zero, there is no evidence, on average, of a difference between the RBCs and type2pneumocytes.The average difference between the two cell types is not statistically significant.

CONCLUSION

From the box plot, there is no strong evidence of outliers or skews to reject the normality assumption. This, paired with the sufficient sample size, allows us to make a reasonable assumption of normality. Given that the samples are also independent, the parametric student's t-test was chosen for hypothesis testing. Using a pairwise t-test, it was noted that the RBCs had no significant differences compared to the other cell types. This was further confirmed by conducting individual student t-tests.