

# Comparison of exons grouped into: NEURAL-UP, NEURAL-DOWN, AS-noNeural

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Matt version 1.2.0

## Contents

<b>1</b>	<b>Infos</b>	<b>4</b>
<b>2</b>	<b>Warning: Please read this note carefully</b>	<b>4</b>
<b>3</b>	<b>Notes for publishing results</b>	<b>4</b>
<b>4</b>	<b>Data sets</b>	<b>5</b>
<b>5</b>	<b>Overview: Features with statistical significant differences (<math>p\text{-val} \leq 0.05</math>)</b>	<b>6</b>
<b>6</b>	<b>Details: Box plots and statistical assessments for all features</b>	<b>21</b>
6.1	EXON LENGTH . . . . .	21
6.2	UPEXON MEDIANLENGTH . . . . .	22
6.3	DOEXON MEDIANLENGTH . . . . .	23
6.4	RATIO UPEXON EXON LENGTH . . . . .	24
6.5	RATIO DOEXON EXON LENGTH . . . . .	25
6.6	UPINTRON MEDIANLENGTH . . . . .	26
6.7	DOINTRON MEDIANLENGTH . . . . .	27
6.8	RATIO UPINTRON EXON LENGTH . . . . .	28
6.9	RATIO DOINTRON EXON LENGTH . . . . .	29
6.10	EXON GCC . . . . .	30
6.11	UPINTRON GCC . . . . .	31
6.12	UPEXON GCC . . . . .	32
6.13	DOINTRON GCC . . . . .	33
6.14	DOEXON GCC . . . . .	34

6.15	RATIO UPEXON EXON GCC	35
6.16	RATIO UPINTRON EXON GCC	36
6.17	RATIO DOINTRON EXON GCC	37
6.18	RATIO DOEXON EXON GCC	38
6.19	SF1 HIGHESTSCORE 3SS UPINTRON	39
6.20	SF1 HIGHESTSCORE 3SS DOINTRON	40
6.21	UP 5SS 20INT10EX GCC	41
6.22	GCC 3SS 20INT10EX	42
6.23	GCC 5SS 20INT10EX	43
6.24	DO 3SS 20INT10EX GCC	44
6.25	MAXENTSCR HSAMODEL UPSTRM 5SS	45
6.26	MAXENTSCR HSAMODEL 3SS	46
6.27	MAXENTSCR HSAMODEL 5SS	47
6.28	MAXENTSCR HSAMODEL DOWNSTRM 3SS	48
6.29	DIST FROM MAXBP TO 3SS UPINTRON	49
6.30	SCORE FOR MAXBP SEQ UPINTRON	50
6.31	PYRIMIDINECONT MAXBP UPINTRON	51
6.32	POLYPYRITRAC OFFSET MAXBP UPINTRON	52
6.33	POLYPYRITRAC LEN MAXBP UPINTRON	53
6.34	POLYPYRITRAC SCORE MAXBP UPINTRON	54
6.35	BPScore MAXBP UPINTRON	55
6.36	NUM PREDICTED BPS UPINTRON	56
6.37	MEDIAN DIST FROM BP TO 3SS UPINTRON	57
6.38	MEDIAN SCORE FOR BPSEQ UPINTRON	58
6.39	MEDIAN PYRIMIDINECONT UPINTRON	59
6.40	MEDIAN POLYPYRITRAC OFFSET UPINTRON	60
6.41	MEDIAN POLYPYRITRAC LEN UPINTRON	61
6.42	MEDIAN POLYPYRITRAC SCORE UPINTRON	62
6.43	MEDIAN BPScore UPINTRON	63
6.44	DIST FROM MAXBP TO 3SS DOINTRON	64
6.45	SCORE FOR MAXBP SEQ DOINTRON	65
6.46	PYRIMIDINECONT MAXBP DOINTRON	66
6.47	POLYPYRITRAC OFFSET MAXBP DOINTRON	67
6.48	POLYPYRITRAC LEN MAXBP DOINTRON	68
6.49	POLYPYRITRAC SCORE MAXBP DOINTRON	69
6.50	BPScore MAXBP DOINTRON	70
6.51	NUM PREDICTED BPS DOINTRON	71
6.52	MEDIAN DIST FROM BP TO 3SS DOINTRON	72
6.53	MEDIAN SCORE FOR BPSEQ DOINTRON	73
6.54	MEDIAN PYRIMIDINECONT DOINTRON	74
6.55	MEDIAN POLYPYRITRAC OFFSET DOINTRON	75
6.56	MEDIAN POLYPYRITRAC LEN DOINTRON	76
6.57	MEDIAN POLYPYRITRAC SCORE DOINTRON	77
6.58	MEDIAN BPScore DOINTRON	78

6.59	MEDIAN TR LENGTH . . . . .	79
6.60	MEDIAN EXON NUMBER . . . . .	80
6.61	EXON MEDIANRELATIVERANK . . . . .	81
6.62	EXON MEDIANRELATIVERANK 3BINS . . . . .	82
6.63	EXON MEDIANRELATIVERANK 5BINS . . . . .	83
6.64	EXON MEDIANRELATIVERANK 10BINS . . . . .	84
6.65	NTRS ALL FOR GENE . . . . .	85
6.66	PROP FIRST EXON . . . . .	86
6.67	PROP LAST EXON . . . . .	87
6.68	PROP INTERNAL EXON . . . . .	88
6.69	PROP EXON IN UTR . . . . .	89

## 1 Infos

Visualizations of exon features for different groups of exons. Each exon occurs in exactly one gene, but might occur in several transcripts of that gene. Hence, for some features like the exon length, there is exactly one value for each exon. For other features, e.g., length of the up-stream exon(s), which could be different in different transcripts, there might be several values for each exon. Consequently, in the latter cases, the median of these value gets reported.

## 2 Warning: Please read this note carefully

Please keep in mind that some features might affect other features. Especially: all branch-point features get extracted from sub-sequences of introns, by standard the last 150 nt at the 3' end of each intron (if you haven't changed this) always neglecting the first 20 nt at their 5' end. If introns of one set are especially short, i.e., many are shorter than these 150 nt, then the shorter intron length might affect branch-point features. For example, there might be less branch points found in shorter introns or their distance to the 3' intron ends might be generally shorter simply because of their shorter intron length.

## 3 Notes for publishing results

When publishing results wrt. splice site strengths which you determined for your data using matt, please cite: *Maximum entropy modeling of short sequence motifs with applications to RNA splicing signals*, Yeo et al., 2003, DOI: 10.1089/1066527041410418

When publishing results wrt. branch point features which you determined for your data with matt, please cite: *Genome-wide association between branch point properties and alternative splicing*, Corvelo et al., 2010, DOI: 10.1371/journal.pcbi.1001016

When publishing results with respect to the binding strength of the human Sf1 splicing factor, you might refer to where the Sf1 binding motif comes from: *Analysis of in situ pre-mRNA targets of human splicing factor SF1 reveals a function in alternative splicing*, Margherita Corioni, Nicolas Antih, Goranka Tanackovic, Mihaela Zavolan, and Angela Kramer, 2011, DOI: 10.1093/nar/gkq1042

The Sf1 binding motif is described in supplement, page 13, table S2: Weight matrix of the binding specificity of SF1.

## 4 Data sets

Input file:

`exons_testsets.tab`

Selection criteria for defining exons groups:

`NEURAL-UP` : having value `NEURAL-UP` in column `GROUP`

`NEURAL-DOWN` : having value `NEURAL-DOWN` in column `GROUP`

`AS_noNeural` : having value `AS_noNeural` in column `GROUP`

Exon duplicates removal: yes

Numbers of exons per group before / after neglecting exons which were not found in GTF file (gene annotation). For the comparisons only exons which were found in the gene annotation are used. These numbers might change slightly for each feature if NAs occur.

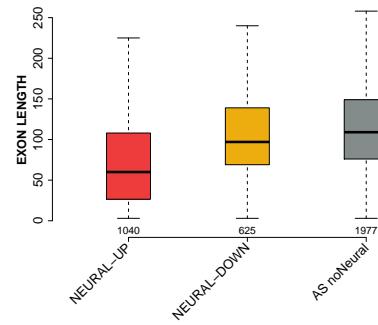
`NEURAL-UP`: 1045 / 1040

`NEURAL-DOWN`: 631 / 625

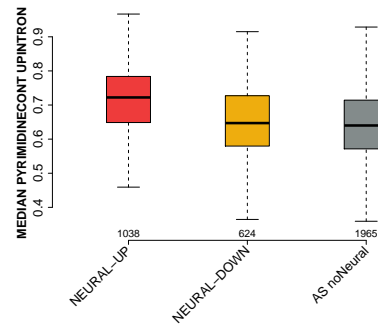
`AS_noNeural`: 2000 / 1977

## 5 Overview: Features with statistical significant differences (p-val $\leq 0.05$ )

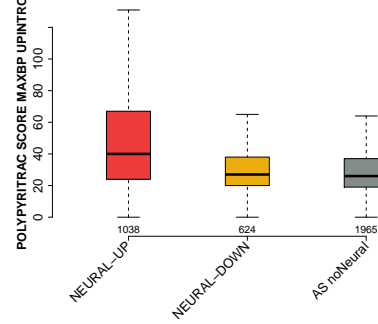
### EXON LENGTH



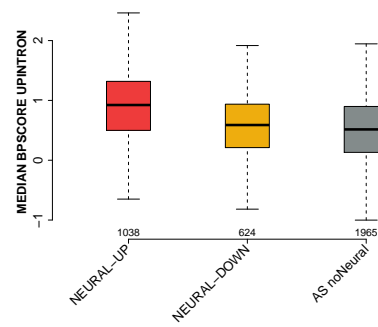
### MEDIAN PYRIMIDINECONT UPINTRON



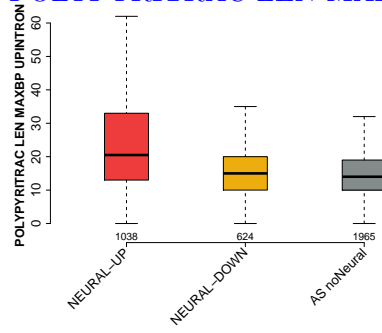
### POLYPYRITRAC SCORE MAXBP UPINTRON



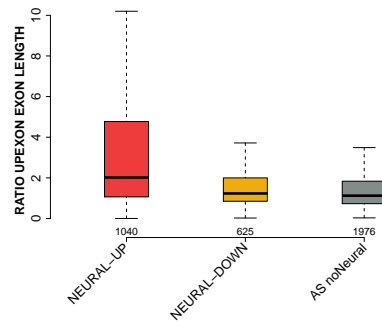
### MEDIAN BPScore UPINTRON



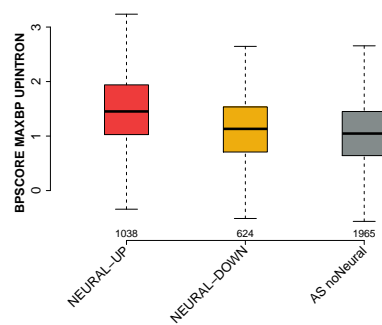
### POLYPYRITRAC LEN MAXBP UPINTRON



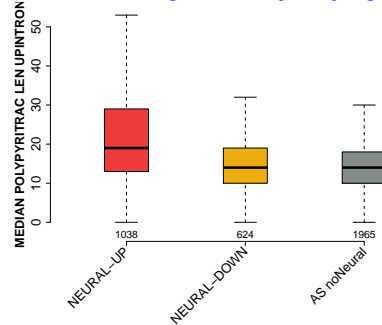
### RATIO UPEXON EXON LENGTH



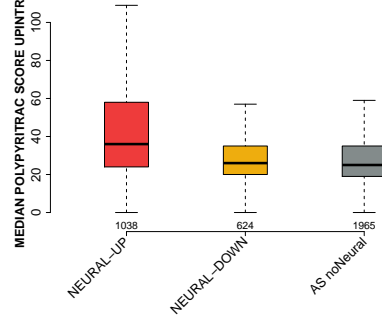
### BPSCORE MAXBP UPINTRON



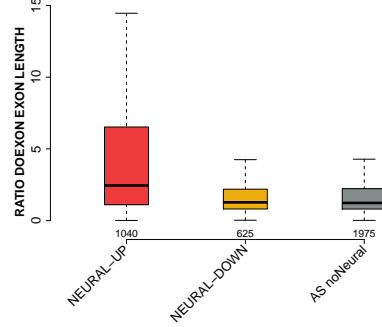
### MEDIAN POLYPYRITRAC LEN UPINTRON



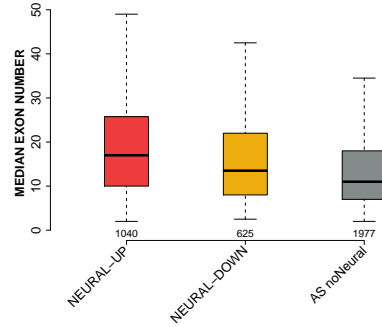
### MEDIAN POLYPYRITRAC SCORE UPINTRON



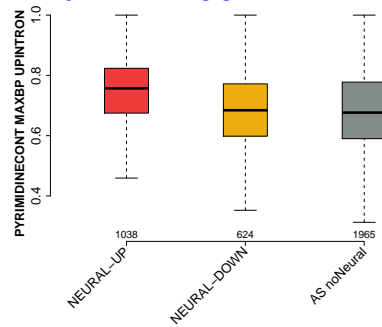
### RATIO DOEXON EXON LENGTH



### MEDIAN EXON NUMBER

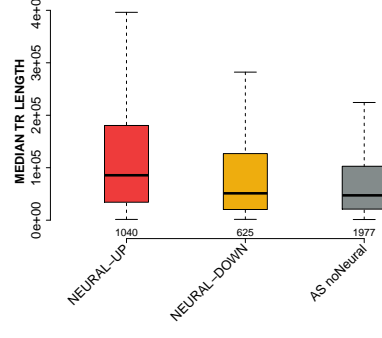


### PYRIMIDINECONT MAXBP UPINTRON

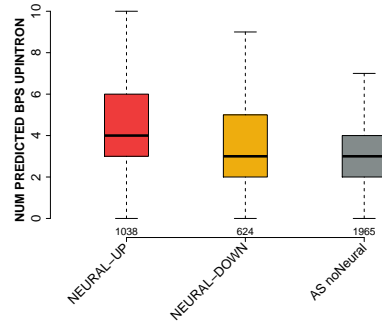




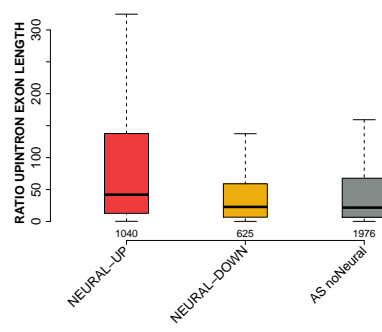
### MEDIAN TR LENGTH



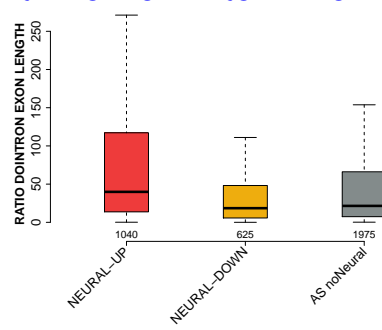
### NUM PREDICTED BPS UPINTRON



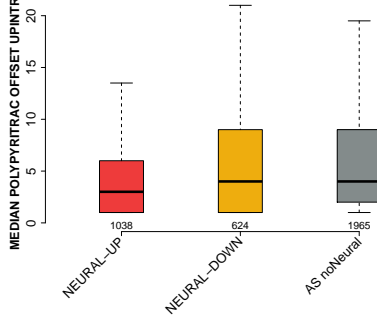
### RATIO UPINTRON EXON LENGTH



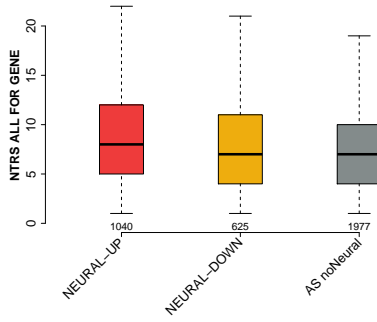
### RATIO DOWINTRON EXON LENGTH



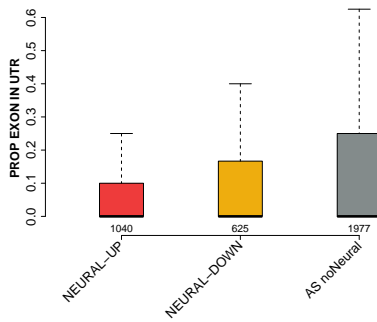
### MEDIAN POLYPYRITRAC OFFSET UPINTRON



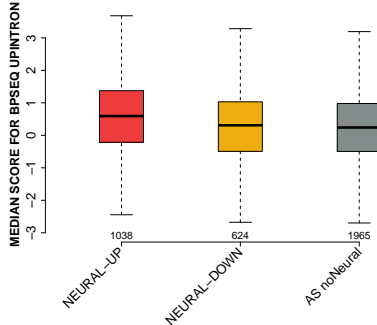
### NTRS ALL FOR GENE



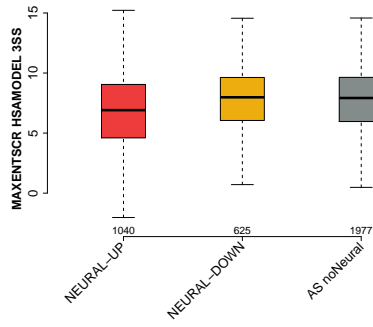
### PROP EXON IN UTR



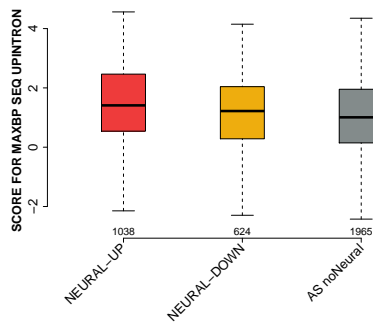
### MEDIAN SCORE FOR BPSEQ UPINTRON



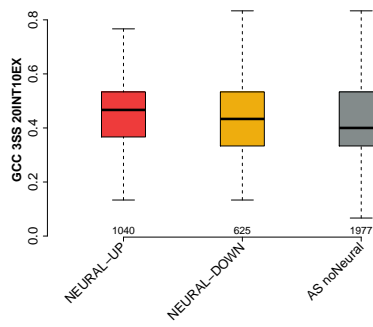
### MAXENTSCR HSAMODEL 3SS



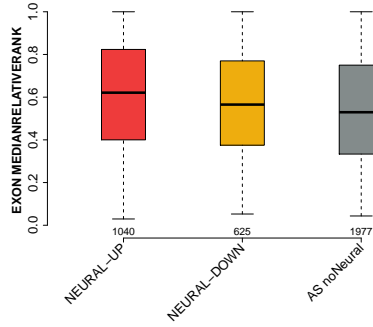
### SCORE FOR MAXBP SEQ UPINTRON



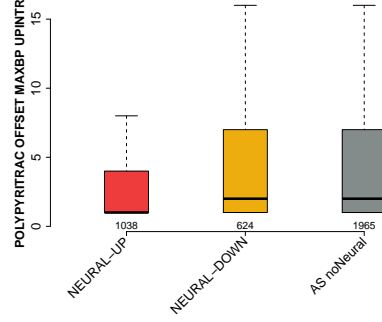
### GCC 3SS 20INT10EX



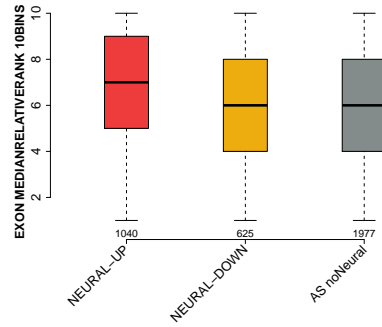
### EXON MEDIANRELATIVRANK



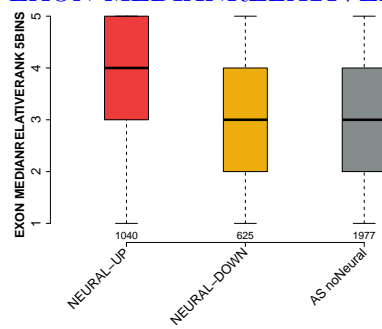
## POLYPYRITRAC OFFSET MAXBP UPINTRC



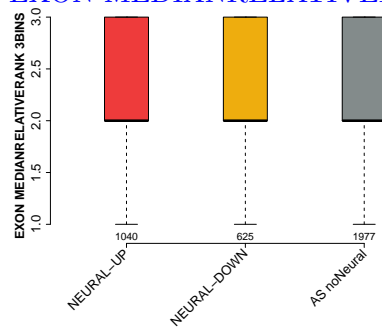
## EXON MEDIANRELATIVERANK 10BINS



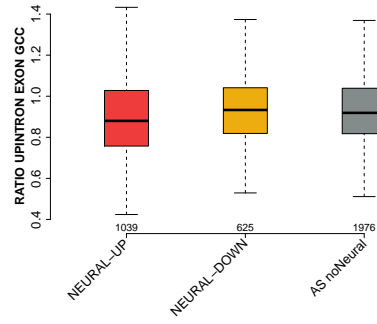
## EXON MEDIANRELATIVERANK 5BINS



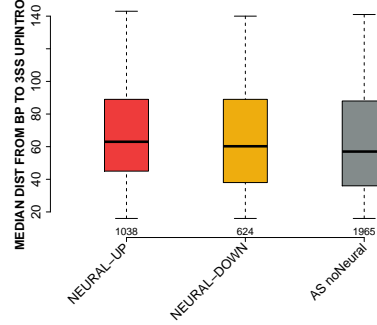
## EXON MEDIANRELATIVERANK 3BINS



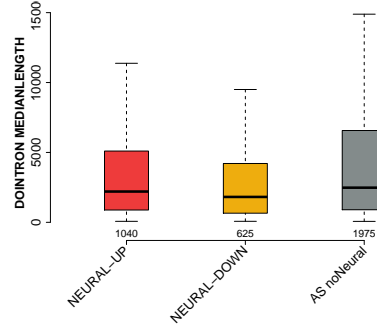
### RATIO UPINTRON EXON GCC



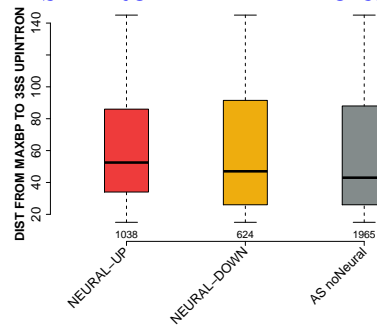
### MEDIAN DIST FROM BP TO 3SS UPINTRON



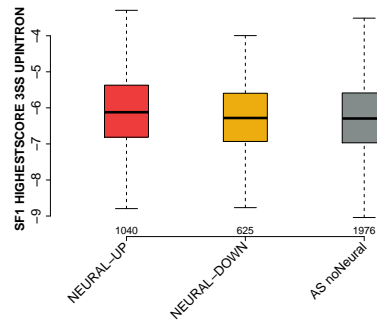
### DOINTRON MEDIANLENGTH



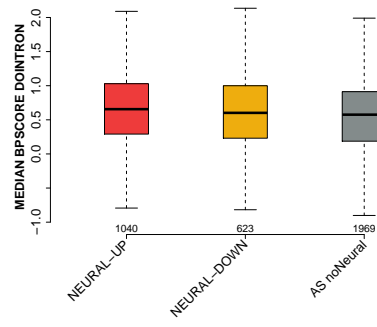
### DIST FROM MAXBP TO 3SS UPINTRON



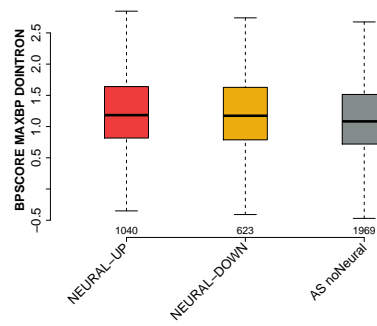
### SF1 HIGHESTSCORE 3SS UPINTRON



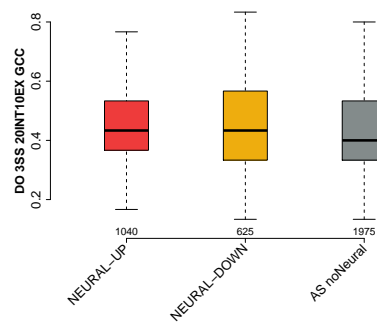
### MEDIAN BPSCORE DOWINTRON



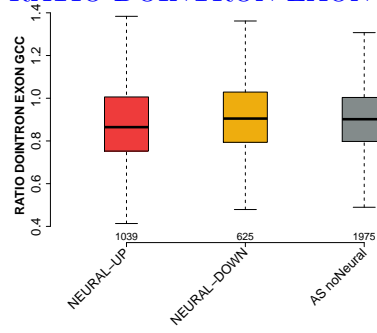
### BPSCORE MAXBP DOWINTRON



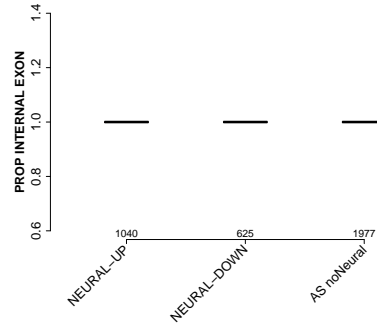
### DO 3SS 20INT10EX GCC



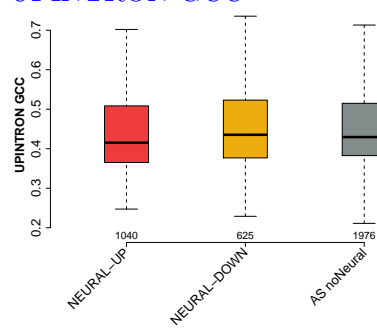
### RATIO DOWNTON EXON GCC



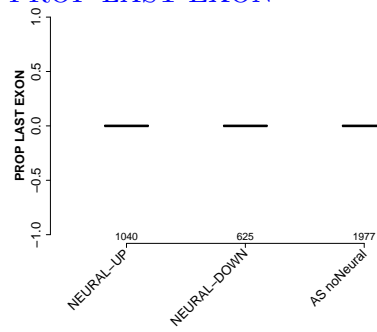
### PROP INTERNAL EXON



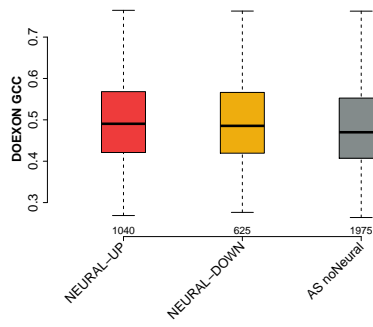
### UPINTRON GCC



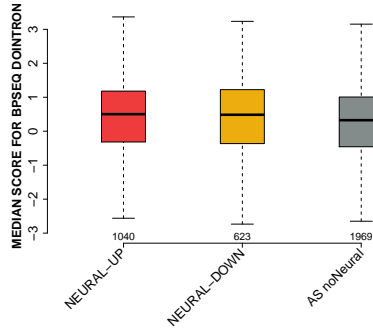
### PROP LAST EXON



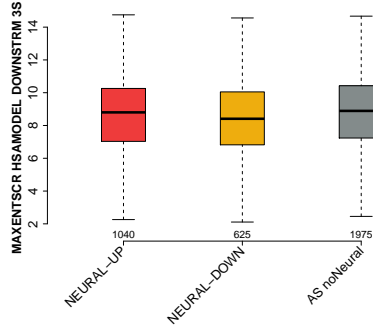
### DOEXON GCC



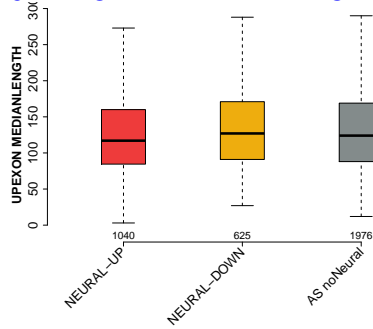
### MEDIAN SCORE FOR BPSEQ DOWINTRON



### MAXENTSCR HSAMODEL DOWNSTRM 3SS

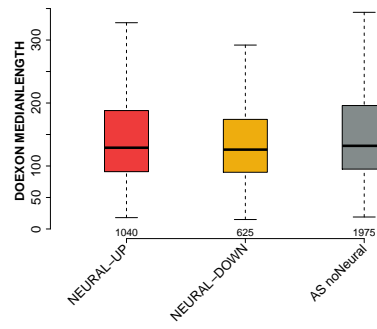


### UPEXON MEDIANLENGTH

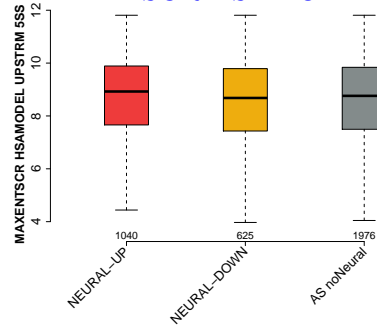




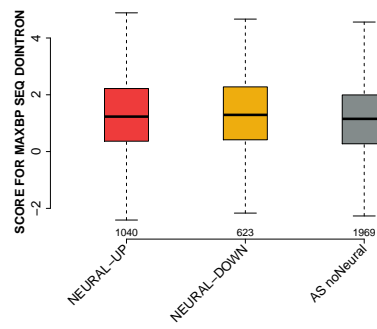
## DOEXON MEDIANLENGTH



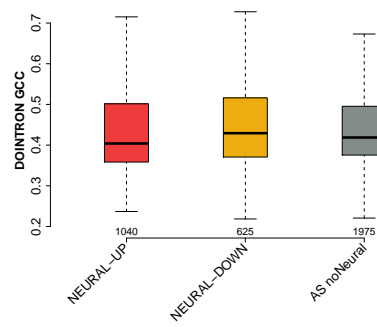
## MAXENTSCR HSAMODEL UPSTRM 5SS



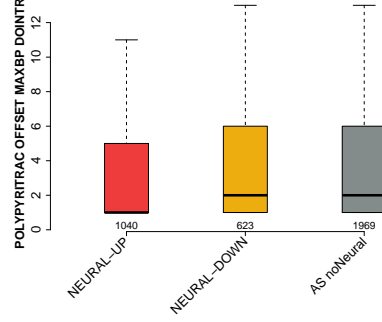
## SCORE FOR MAXBP SEQ DOINTRON



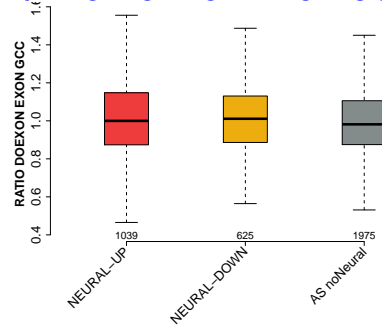
## DOINTRON GCC



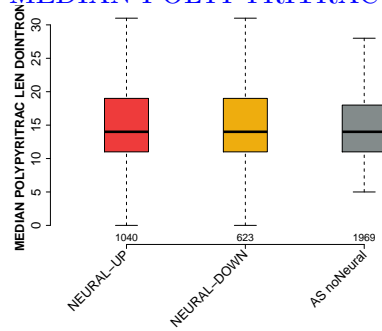
### POLYPYRITRAC OFFSET MAXBP DONTRON



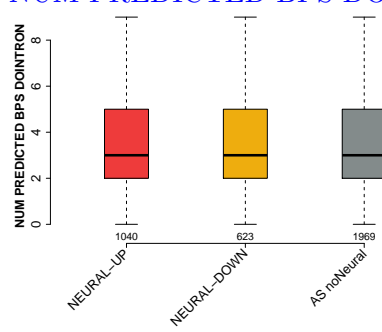
### RATIO DOEXON EXON GCC



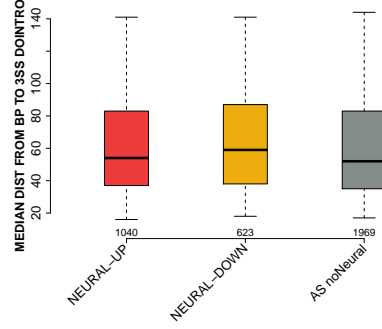
### MEDIAN POLYPYRITRAC LEN DONTRON



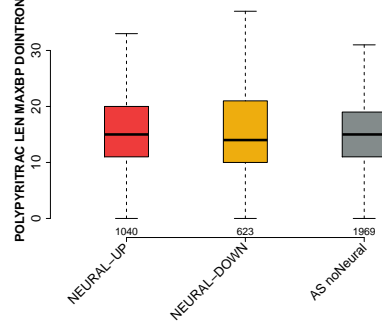
### NUM PREDICTED BPS DONTRON



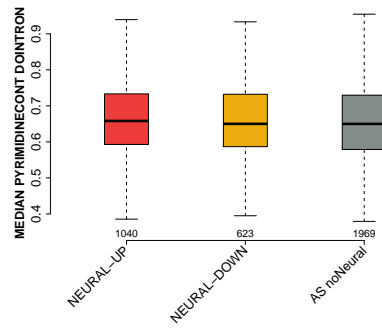
### MEDIAN DIST FROM BP TO 3SS DOWNTON



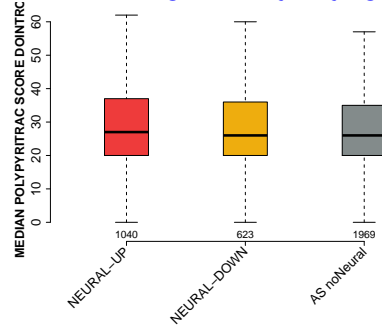
### POLYPYRITRAC LEN MAXBP DOWNTON



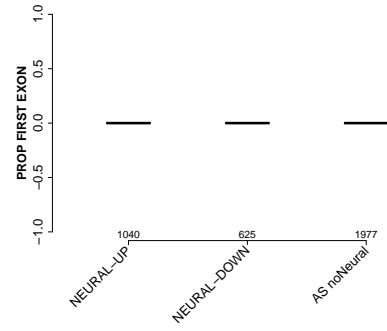
### MEDIAN PYRIMIDINECONT DOWNTON



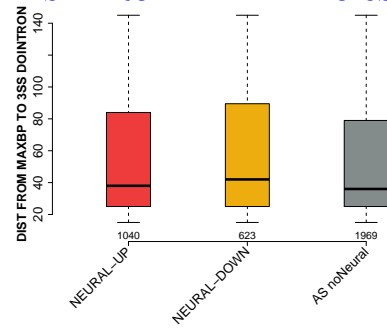
### MEDIAN POLYPYRITRAC SCORE DOWNTON



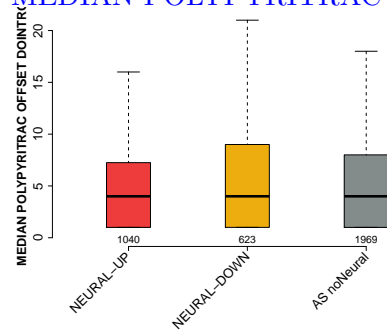
### PROP FIRST EXON



### DIST FROM MAXBP TO 3SS DOINTRON



### MEDIAN POLYPYRITRAC OFFSET DOINTRON

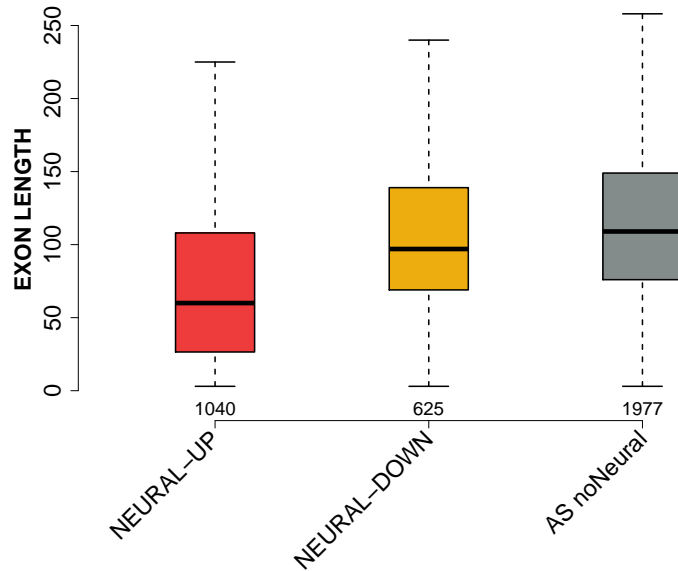


## 6 Details: Box plots and statistical assessments for all features

### 6.1 EXON LENGTH

Back to: [Overview](#) | [ToC](#)

Meaning:



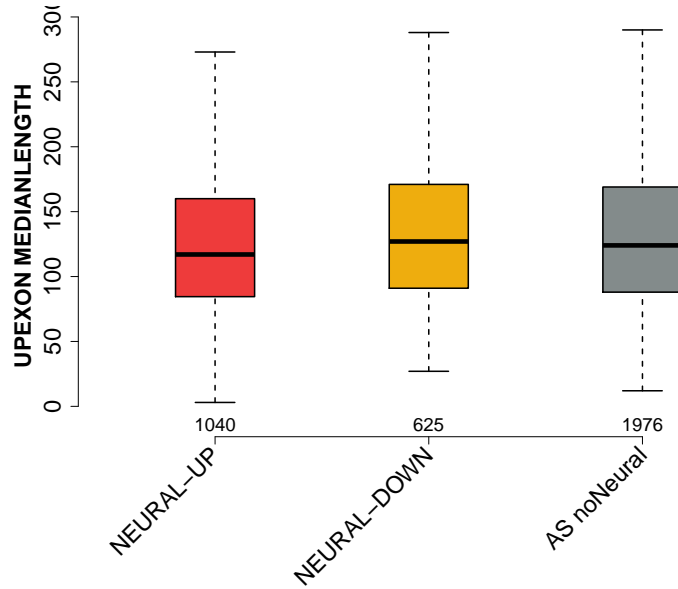
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 2.38783e-38  
mean: 100.4673 < 135.6208 , median: 60 < 97
- NEURAL-UP vs AS\_noNeural : 3.28289e-95  
mean: 100.4673 < 140.8139 , median: 60 < 109
- NEURAL-DOWN vs AS\_noNeural : 8.05669e-06  
mean: 135.6208 < 140.8139 , median: 97 < 109

## 6.2 UPEXON MEDIANLENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median length of up-stream exon



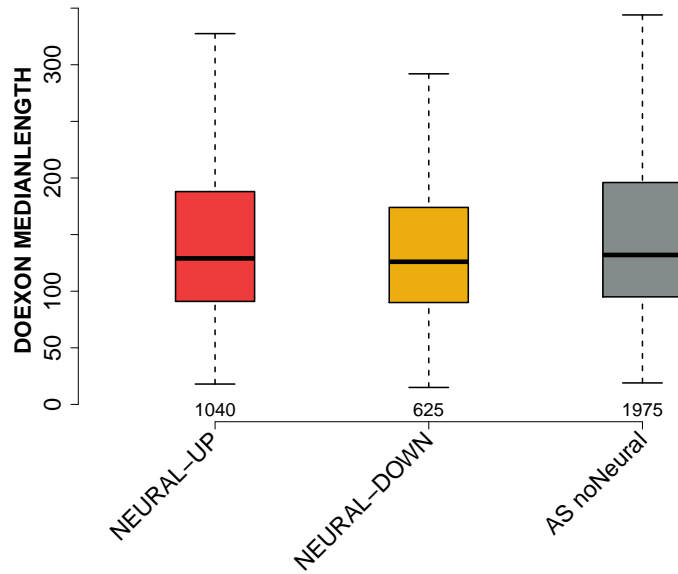
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00230377  
mean: 146.4755 < 163.5192 , median: 117 < 127
- NEURAL-UP vs AS\_noNeural : 0.00273025  
mean: 146.4755 < 163.0992 , median: 117 < 124

### 6.3 DOEXON MEDIANLENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median length of down-stream exon



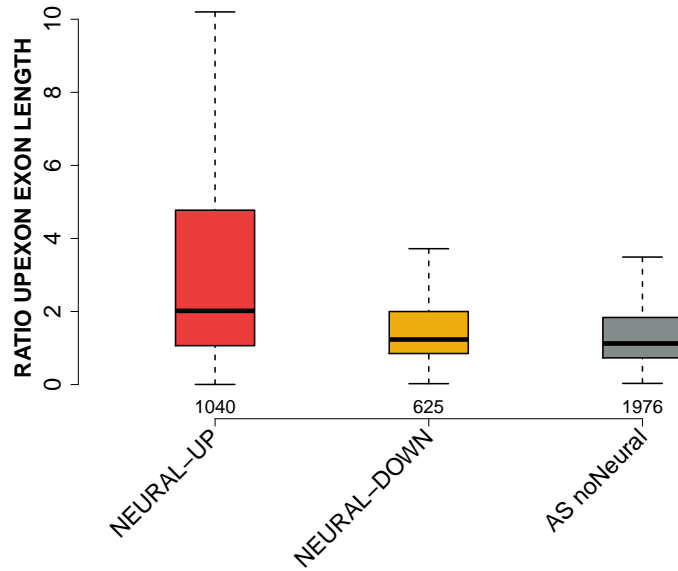
Significant results from Mann-Whitney U test:

- NEURAL-DOWN vs AS\_noNeural : 0.00275048  
mean: 227.6824 < 274.4101 , median: 126 < 132

## 6.4 RATIO UPEXON EXON LENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median up-stream exon length / exon length



Significant results from Mann-Whitney U test:

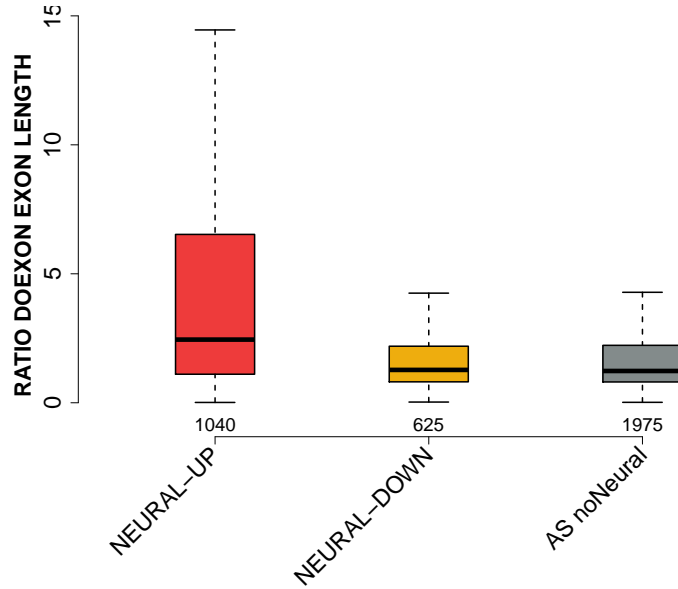
- NEURAL-UP vs NEURAL-DOWN : 7.69419e-25  
mean: 4.2769 > 1.9263 , median: 2.0181 > 1.2338
- NEURAL-UP vs AS\_noNeural : 1.02892e-60  
mean: 4.2769 > 1.7302 , median: 2.0181 > 1.125
- NEURAL-DOWN vs AS\_noNeural : 0.000681045  
mean: 1.9263 > 1.7302 , median: 1.2338 > 1.125



## 6.5 RATIO DOEXON EXON LENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median down-stream exon length / exon length



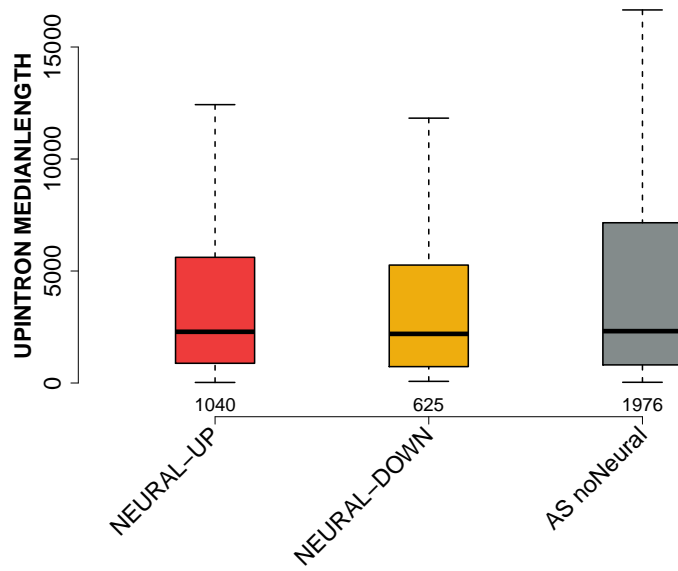
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN :  $2.85997e-30$   
mean:  $8.1484 > 2.6613$  , median:  $2.4484 > 1.2738$
- NEURAL-UP vs AS\_noNeural :  $6.91821e-50$   
mean:  $8.1484 > 2.8826$  , median:  $2.4484 > 1.232$

## 6.6 UPINTRON MEDIANLENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median length of up-stream introns



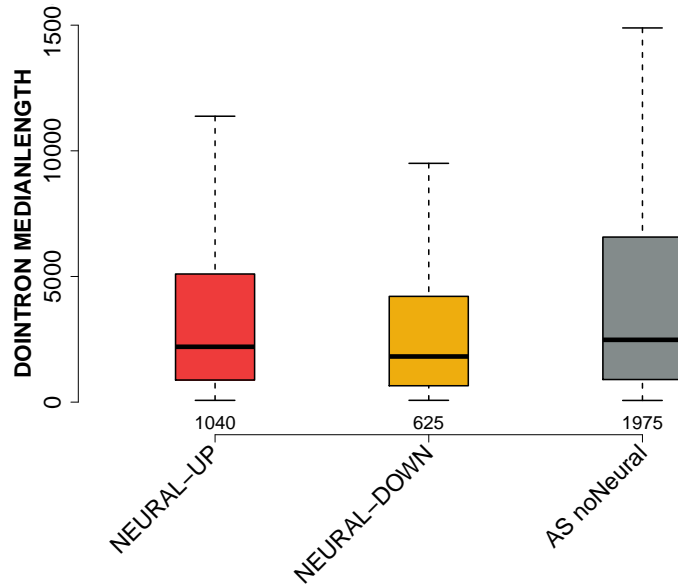
Significant results from Mann-Whitney U test:

- none

## 6.7 DOINTRON MEDIANLENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median length of down-stream introns



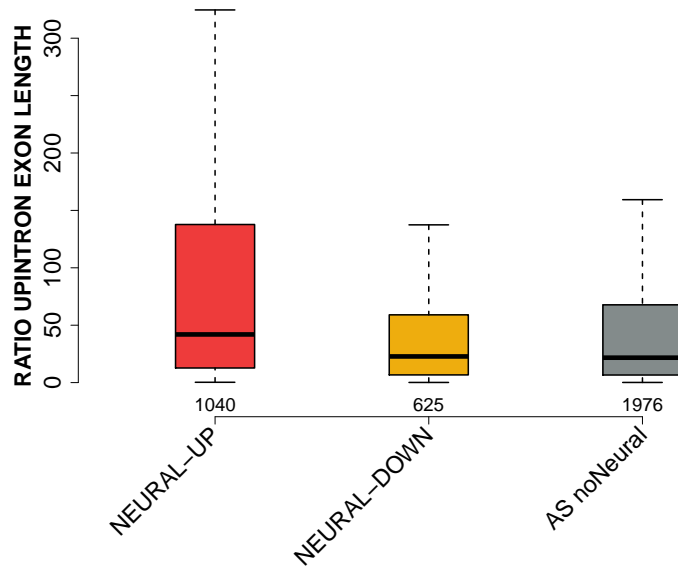
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00166004  
mean: 5165.1808 > 4851.4512 , median: 2202 > 1816
- NEURAL-UP vs AS\_noNeural : 0.028239  
mean: 5165.1808 < 8019.577 , median: 2202 < 2479
- NEURAL-DOWN vs AS\_noNeural : 8.03439e-07  
mean: 4851.4512 < 8019.577 , median: 1816 < 2479

## 6.8 RATIO UPINTRON EXON LENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median up-stream intron length / exon length



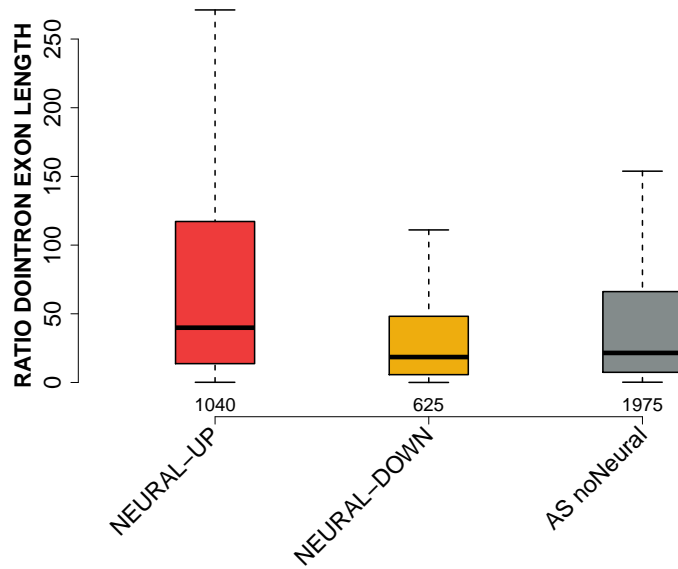
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 4.32258e-16  
mean: 203.7195 > 75.6756 , median: 41.9583 > 22.7835
- NEURAL-UP vs AS\_noNeural : 1.39407e-23  
mean: 203.7195 > 86.2514 , median: 41.9583 > 21.7052

## 6.9 RATIO DOWNTON EXON LENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median down-stream intron length / exon length



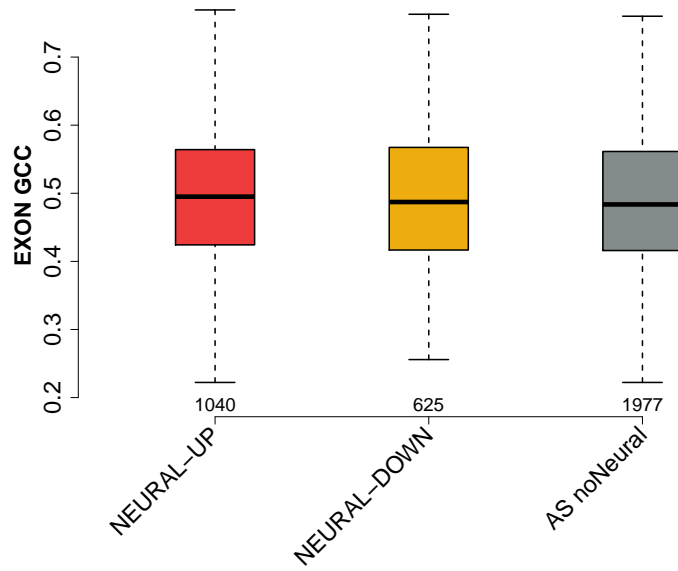
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 3.29324e-23  
mean: 145.4599 > 58.5588 , median: 39.8712 > 18.5077
- NEURAL-UP vs AS\_noNeural : 4.4503e-21  
mean: 145.4599 > 94.3361 , median: 39.8712 > 21.505
- NEURAL-DOWN vs AS\_noNeural : 0.00263095  
mean: 58.5588 < 94.3361 , median: 18.5077 < 21.505

## 6.10 EXON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of entire exon sequence



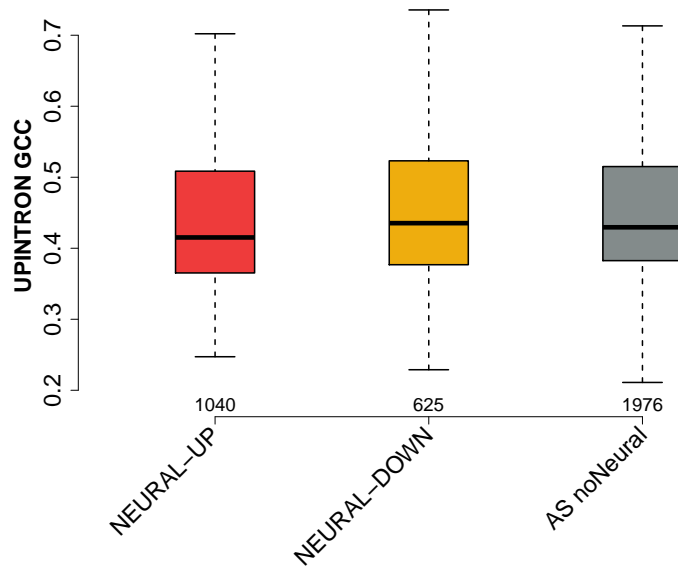
Significant results from Mann-Whitney U test:

- none

## 6.11 UPINTRON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of entire up-stream intron sequence



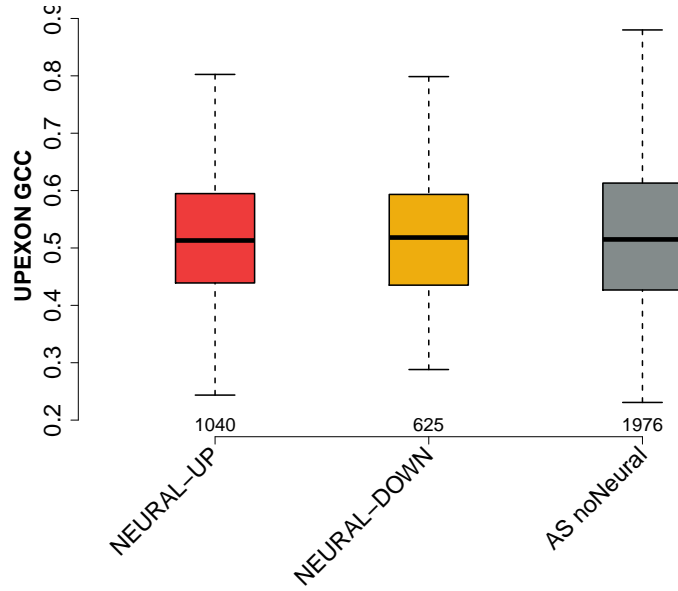
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.000559492  
mean: 0.439719 < 0.456315 , median: 0.415205 < 0.435345
- NEURAL-UP vs AS\_noNeural : 7.79016e-05  
mean: 0.439719 < 0.452348 , median: 0.415205 < 0.429529

## 6.12 UPEXON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of entire up-stream exon sequence



Significant results from Mann-Whitney U test:

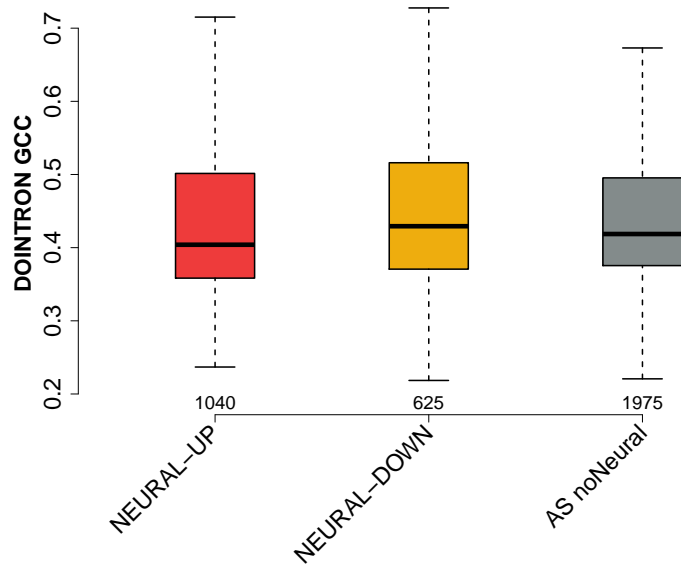
- none



## 6.13 DOINTRON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of entire down-stream intron sequence



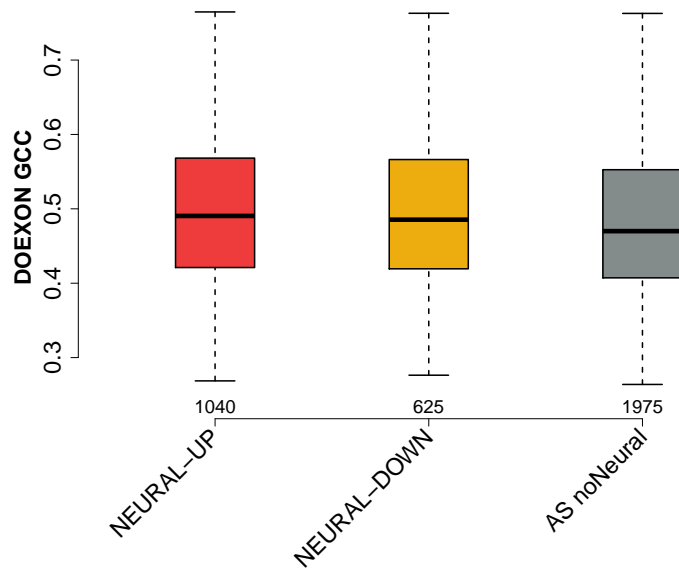
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00500587  
mean: 0.434563 < 0.447653 , median: 0.403984 < 0.429287
- NEURAL-UP vs AS\_noNeural : 0.00472287  
mean: 0.434563 < 0.440268 , median: 0.403984 < 0.418638

## 6.14 DOEXON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of entire down-stream exon sequence



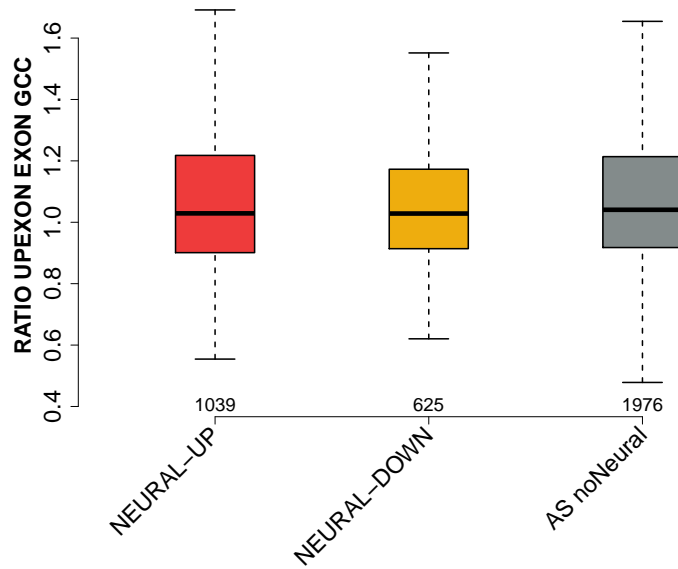
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.000105176  
mean: 0.495361 > 0.481317 , median: 0.490446 > 0.47
- NEURAL-DOWN vs AS\_noNeural : 0.00333887  
mean: 0.493854 > 0.481317 , median: 0.485437 > 0.47

## 6.15 RATIO UPEXON EXON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: UPEXON GCC / EXON GCC



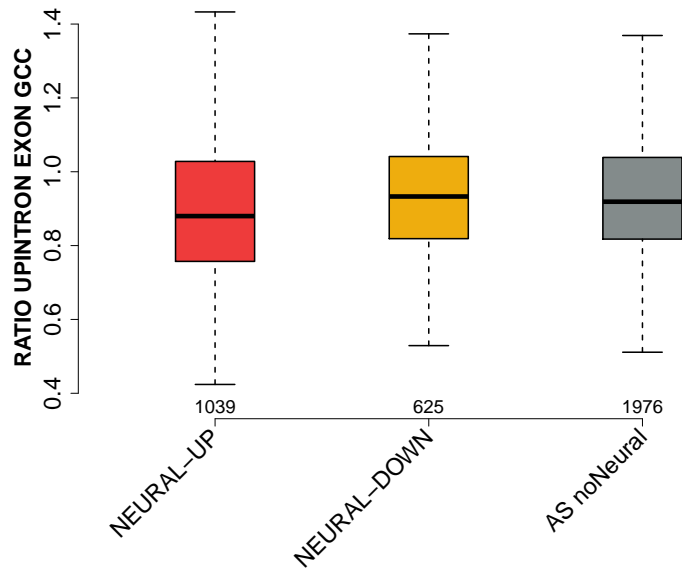
Significant results from Mann-Whitney U test:

- none

## 6.16 RATIO UPINTRON EXON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: UPINTRON GCC / EXON GCC



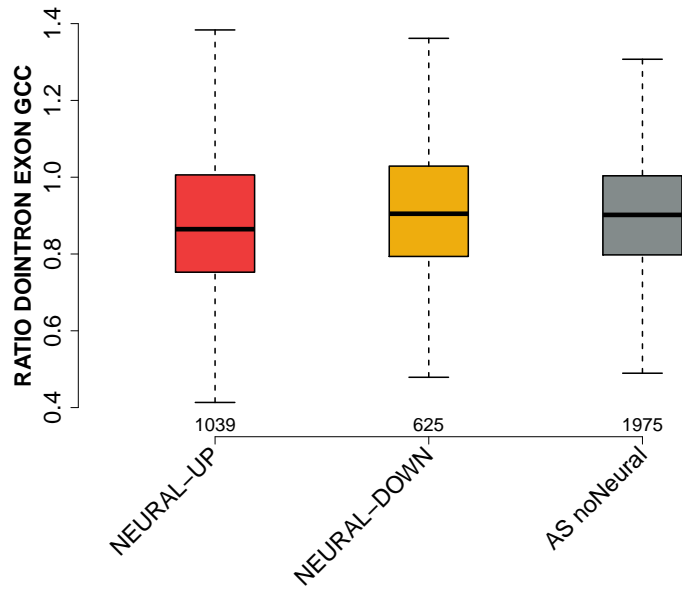
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 5.64606e-06  
mean: 0.913199 < 0.942021 , median: 0.879906 < 0.932947
- NEURAL-UP vs AS\_noNeural : 7.14161e-08  
mean: 0.913199 < 0.938261 , median: 0.879906 < 0.918848

## 6.17 RATIO DOINTRON EXON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: DOINTRON GCC / EXON GCC



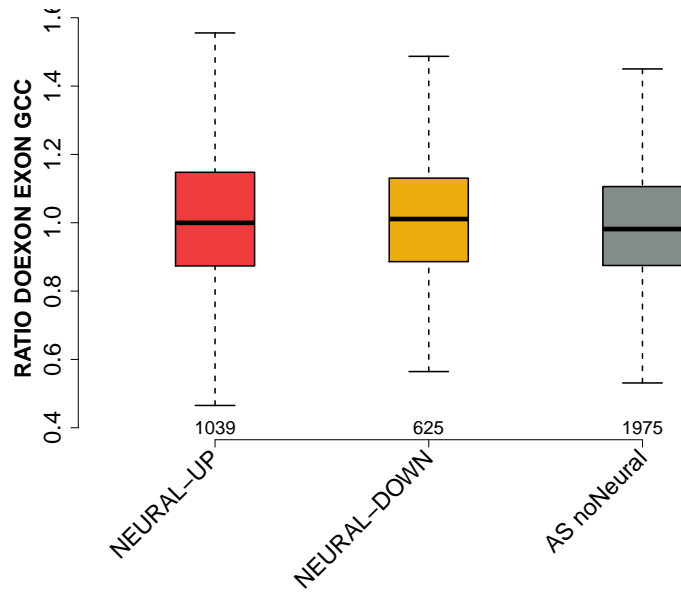
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.000134022  
mean: 0.900733 < 0.923417 , median: 0.864646 < 0.904817
- NEURAL-UP vs AS\_noNeural : 2.202e-05  
mean: 0.900733 < 0.913208 , median: 0.864646 < 0.901837

## 6.18 RATIO DOEXON EXON GCC

Back to: [Overview](#) | [ToC](#)

Meaning: DOEXON GCC / EXON GCC



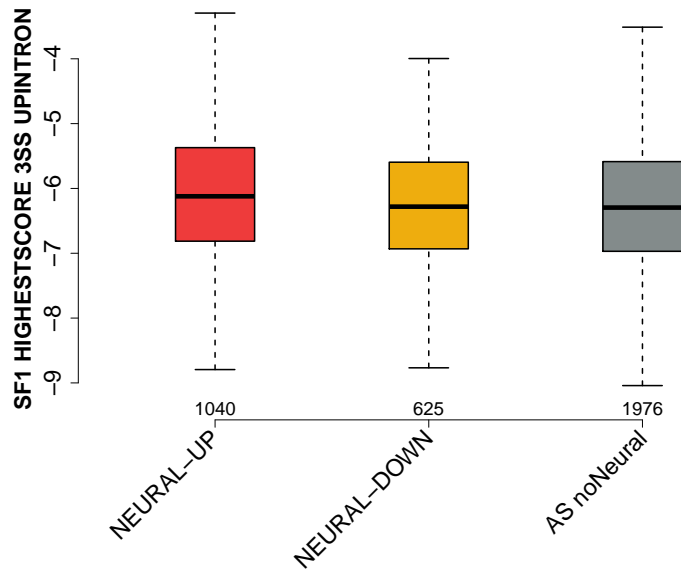
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.0440478  
mean: 1.0334 > 1.0025 , median: 0.999781 > 0.98159
- NEURAL-DOWN vs AS\_noNeural : 0.00565298  
mean: 1.0242 > 1.0025 , median: 1.0109 > 0.98159

## 6.19 SF1 HIGHESTSCORE 3SS UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: highest score of a SF1 position weight matrix trained with human data in the last 150 nt 3 prime intron positions of up-stream intron



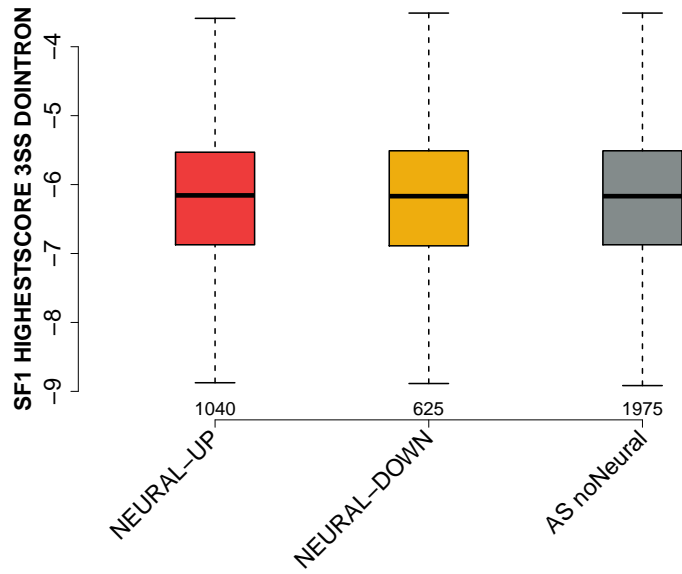
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00105825  
mean: -6.02939 > -6.25343 , median: -6.12133 > -6.28097
- NEURAL-UP vs AS\_noNeural : 5.03501e-06  
mean: -6.02939 > -6.25791 , median: -6.12133 > -6.29538

## 6.20 SF1 HIGHESTSCORE 3SS DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: highest score of a SF1 position weight matrix trained with human data in the last 150 nt 3 prime intron positions of down-stream intron



Significant results from Mann-Whitney U test:

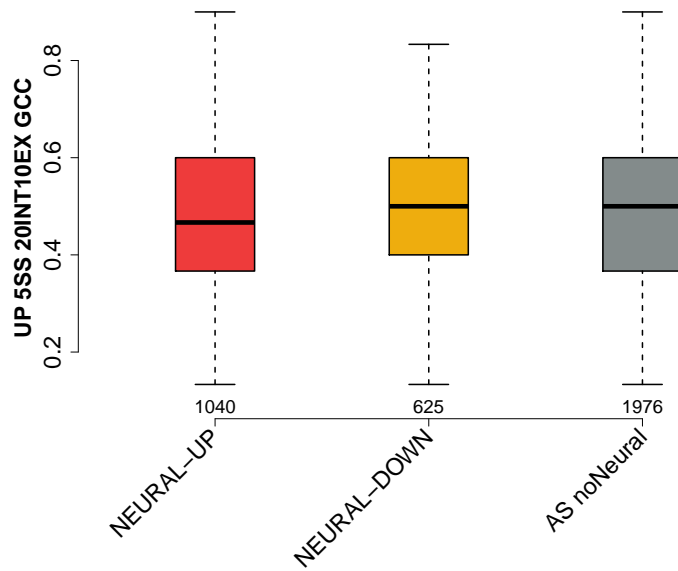
- none



## 6.21 UP 5SS 20INT10EX GCC

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of up-stream 5ss sequence (20int+10ex positions)



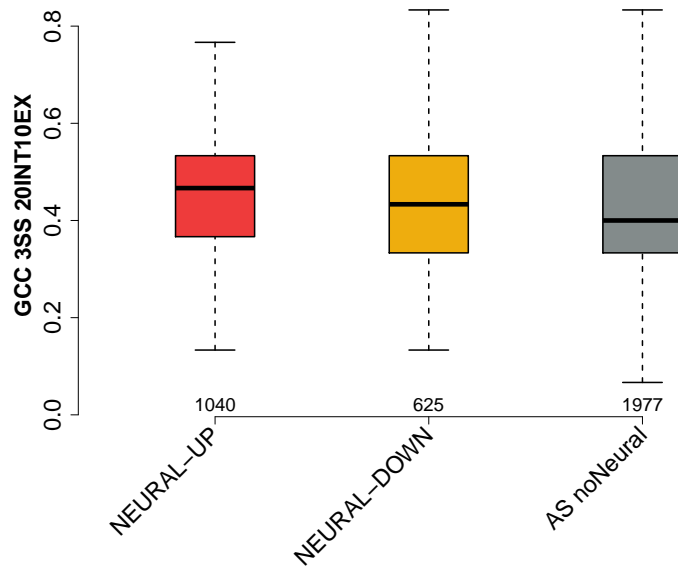
Significant results from Mann-Whitney U test:

- none

## 6.22 GCC 3SS 20INT10EX

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of 3ss sequence (20int+10ex positions)



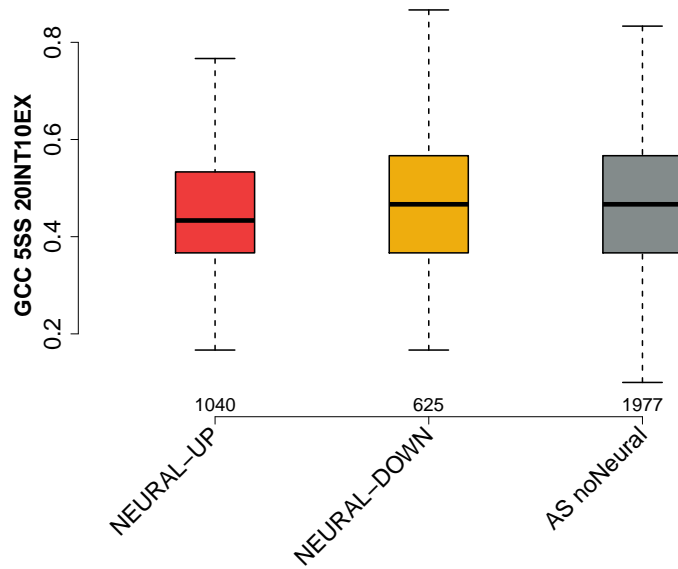
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 3.94565e-05  
mean: 0.462244 > 0.438027 , median: 0.466667 > 0.433333
- NEURAL-UP vs AS\_noNeural : 4.46775e-14  
mean: 0.462244 > 0.426184 , median: 0.466667 > 0.4

## 6.23 GCC 5SS 20INT10EX

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of 5ss sequence (20int+10ex positions)



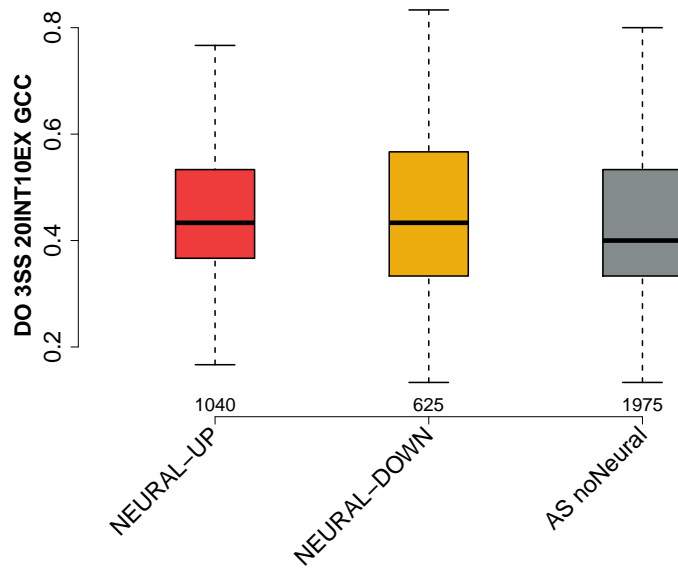
Significant results from Mann-Whitney U test:

- none

## 6.24 DO 3SS 20INT10EX GCC

Back to: [Overview](#) | [ToC](#)

Meaning: GC content of down-stream 3ss sequence (20int+10ex positions)



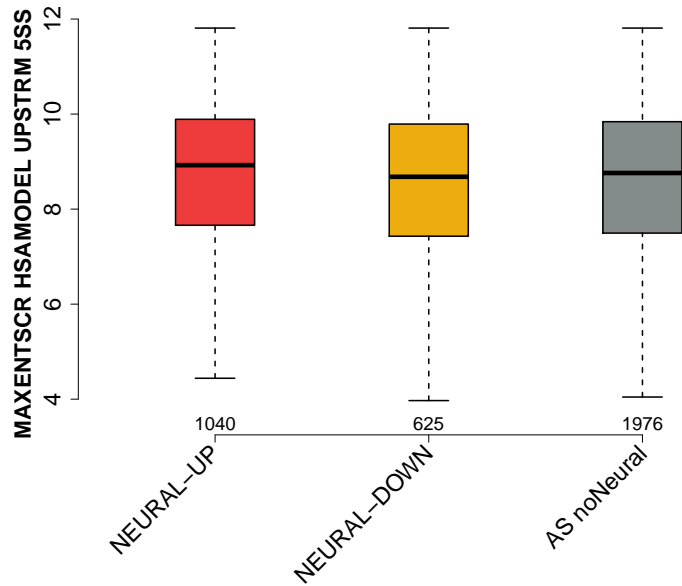
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 1.8476e-05  
mean: 0.444599 > 0.423485 , median: 0.433333 > 0.4
- NEURAL-DOWN vs AS\_noNeural : 0.000593612  
mean: 0.44592 > 0.423485 , median: 0.433333 > 0.4

## 6.25 MAXENTSCR HSAMODEL UPSTRM 5SS

Back to: [Overview](#) | [ToC](#)

Meaning: maximum entropy score of 5ss of up-stream exon using a model trained with human splice sites



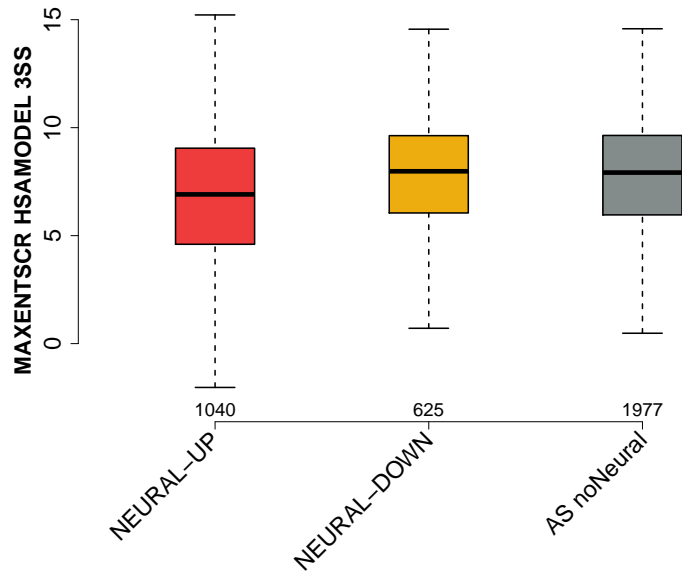
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00302349  
mean: 8.598 > 8.2795 , median: 8.925 > 8.68
- NEURAL-UP vs AS\_noNeural : 0.0362314  
mean: 8.598 > 8.4271 , median: 8.925 > 8.76

## 6.26 MAXENTSCR HSAMODEL 3SS

Back to: [Overview](#) | [ToC](#)

Meaning: maximum entropy score of 3ss using a model trained with human splice sites



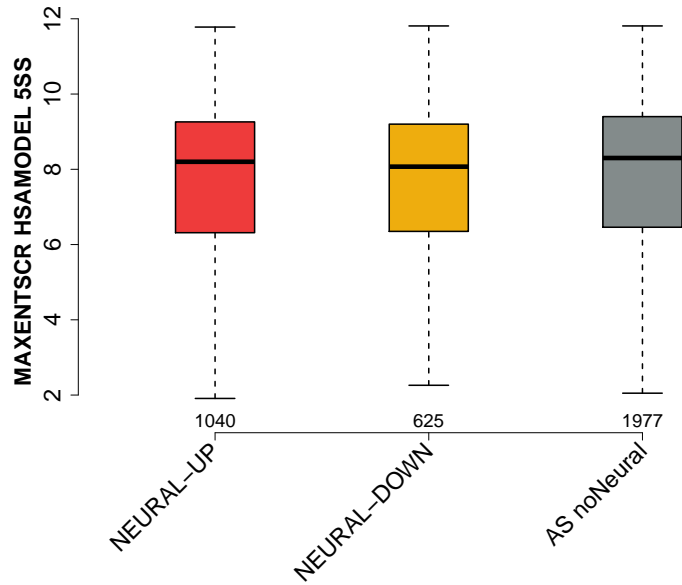
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN :  $2.84914e-10$   
mean:  $6.4668 < 7.5528$  , median:  $6.91 < 7.98$
- NEURAL-UP vs AS\_noNeural :  $3.29395e-15$   
mean:  $6.4668 < 7.5233$  , median:  $6.91 < 7.92$

## 6.27 MAXENTSCR HSAMODEL 5SS

Back to: [Overview](#) | [ToC](#)

Meaning: maximum entropy score of 5ss using a model trained with human splice sites



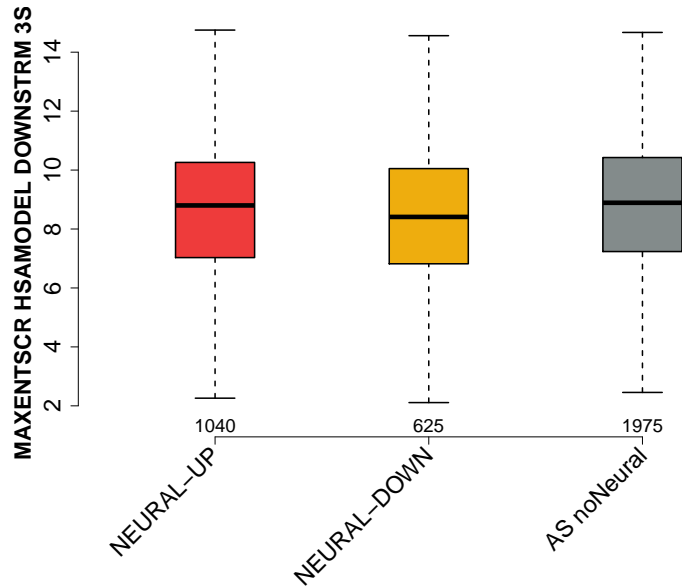
Significant results from Mann-Whitney U test:

- none

## 6.28 MAXENTSCR HSAMODEL DOWNSTRM 3SS

Back to: [Overview](#) | [ToC](#)

Meaning: maximum entropy score of 3ss of down-stream exon using a model trained with human splice sites



Significant results from Mann-Whitney U test:

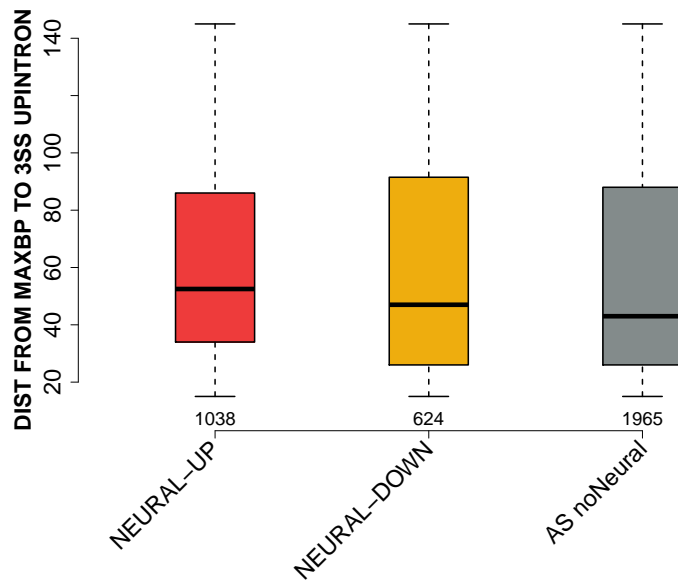
- NEURAL-UP vs AS\_noNeural : 0.0354791  
mean: 8.4728 < 8.7037 , median: 8.8 < 8.89
- NEURAL-DOWN vs AS\_noNeural : 0.000481781  
mean: 8.2737 < 8.7037 , median: 8.41 < 8.89



## 6.29 DIST FROM MAXBP TO 3SS UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: distance to 3ss of best predicted BP



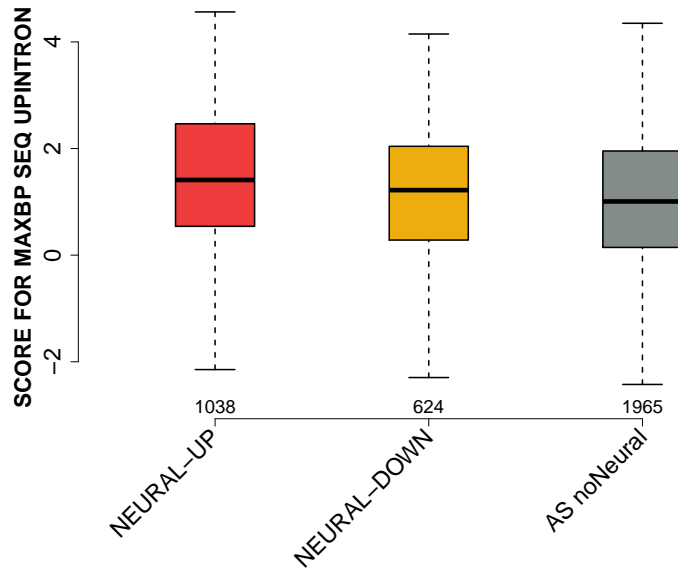
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.023369  
mean: 62.0029 > 61.0433 , median: 52.5 > 47
- NEURAL-UP vs AS\_noNeural : 1.36367e-06  
mean: 62.0029 > 58.6209 , median: 52.5 > 43

### 6.30 SCORE FOR MAXBP SEQ UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: BP sequence score of best predicted BP



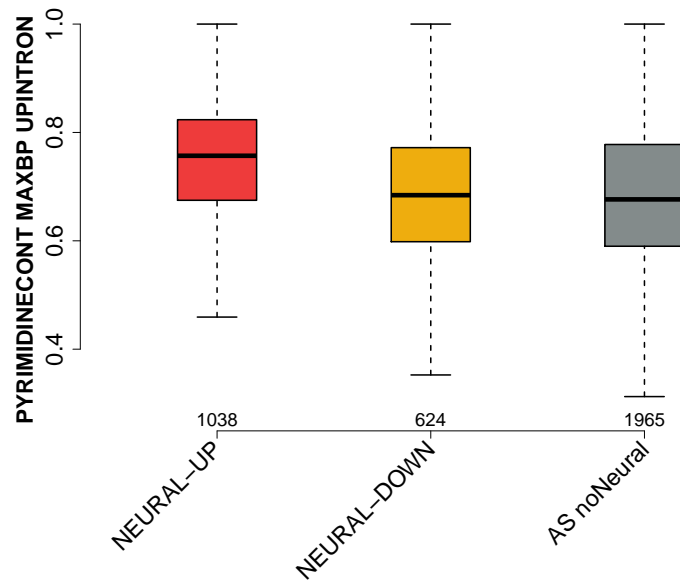
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.000339444  
mean: 1.4519 > 1.2069 , median: 1.4104 > 1.2193
- NEURAL-UP vs AS\_noNeural : 4.08e-14  
mean: 1.4519 > 1.0469 , median: 1.4104 > 1.0072
- NEURAL-DOWN vs AS\_noNeural : 0.0134102  
mean: 1.2069 > 1.0469 , median: 1.2193 > 1.0072

## 6.31 PYRIMIDINECONT MAXBP UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Pyrimidine content between the BP adenine and the 3 prime splice site for best BP



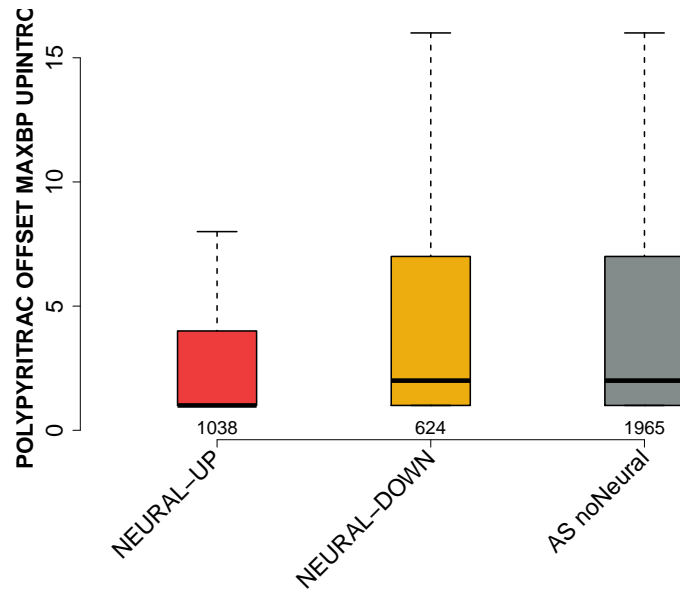
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 1.12222e-25  
mean: 0.746366 > 0.686813 , median: 0.75695 > 0.684211
- NEURAL-UP vs AS\_noNeural : 4.66112e-43  
mean: 0.746366 > 0.68433 , median: 0.75695 > 0.676471

## 6.32 POLYPYRITRAC OFFSET MAXBP UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Polypyrimidine track offset relative to the BP adenine for best BP



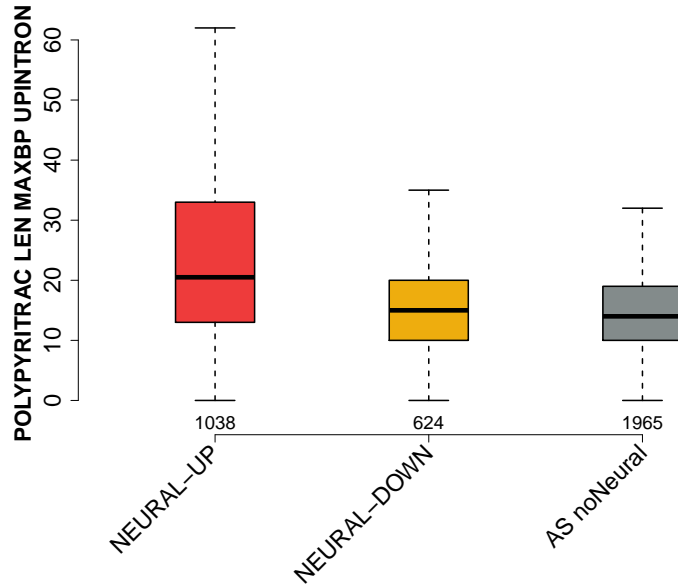
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 4.86655e-09  
mean: 3.4297 < 4.7115 , median: 1 < 2
- NEURAL-UP vs AS\_noNeural : 4.67973e-12  
mean: 3.4297 < 4.7817 , median: 1 < 2

### 6.33 POLYPYRITRAC LEN MAXBP UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Polypyrimidine track length for best BP



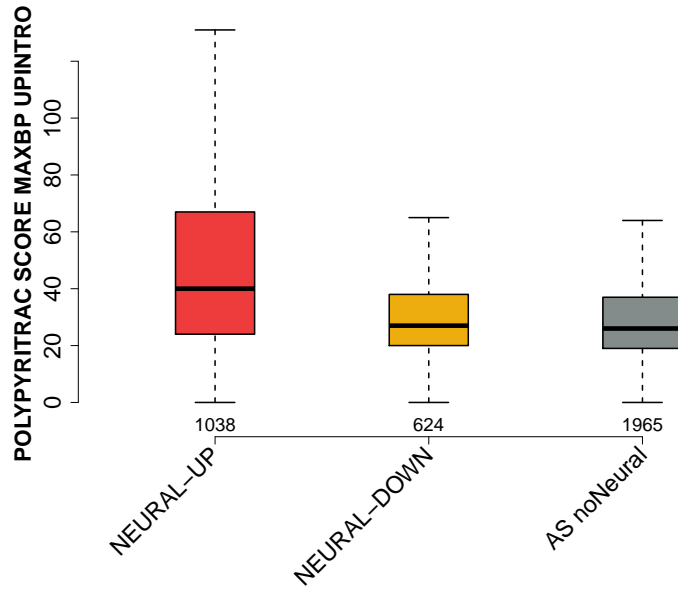
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 1.02998e-25  
mean: 25.9894 > 17.4487 , median: 20.5 > 15
- NEURAL-UP vs AS\_noNeural : 4.28549e-61  
mean: 25.9894 > 15.83 , median: 20.5 > 14
- NEURAL-DOWN vs AS\_noNeural : 0.0224879  
mean: 17.4487 > 15.83 , median: 15 > 14

## 6.34 POLYPYRITRAC SCORE MAXBP UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Polypyrimidine track score for best BP



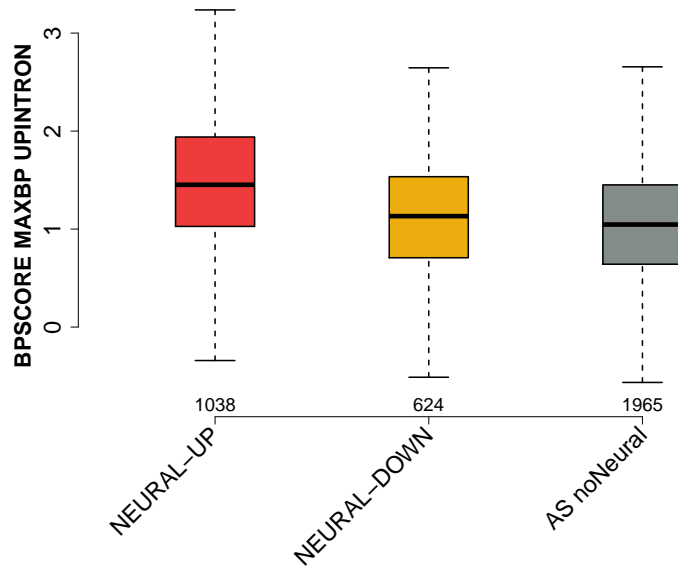
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN :  $1.25972e-29$   
mean:  $51.2013 > 32.7019$  , median:  $40 > 27$
- NEURAL-UP vs AS\_noNeural :  $7.8558e-64$   
mean:  $51.2013 > 30.3985$  , median:  $40 > 26$

## 6.35 BPScore MAXBP UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: SVM classification score of best BP



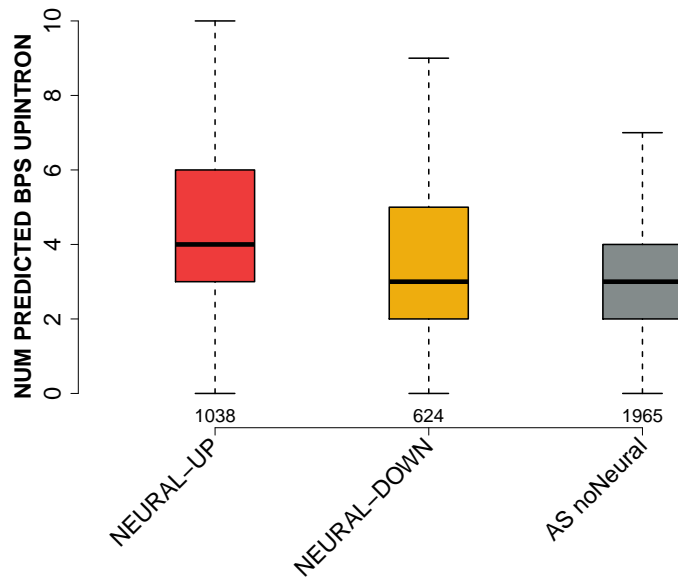
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 7.12888e-25  
mean: 1.4712 > 1.1026 , median: 1.452 > 1.132
- NEURAL-UP vs AS\_noNeural : 6.27393e-60  
mean: 1.4712 > 1.0132 , median: 1.452 > 1.0463
- NEURAL-DOWN vs AS\_noNeural : 0.00846805  
mean: 1.1026 > 1.0132 , median: 1.132 > 1.0463

## 6.36 NUM PREDICTED BPS UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: number of all predicted BPs which have a positive BP score



Significant results from Mann-Whitney U test:

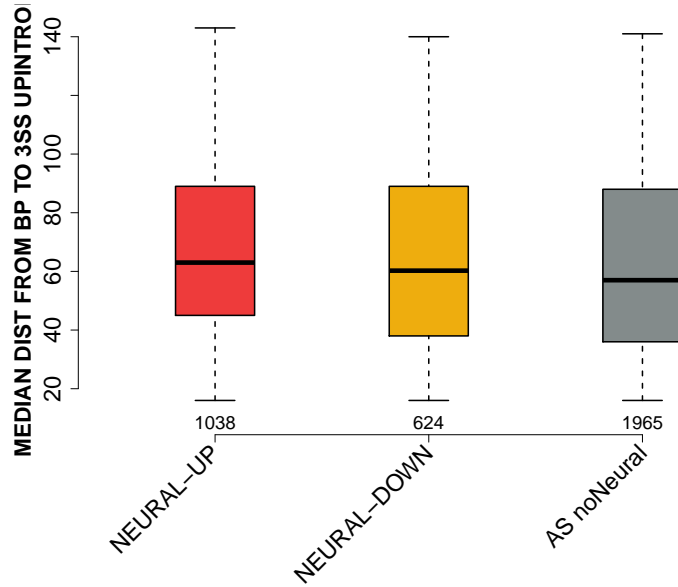
- NEURAL-UP vs NEURAL-DOWN : 2.7634e-09  
mean: 4.1407 > 3.5176 , median: 4 > 3
- NEURAL-UP vs AS\_noNeural : 3.09599e-27  
mean: 4.1407 > 3.2316 , median: 4 > 3
- NEURAL-DOWN vs AS\_noNeural : 0.0137706  
mean: 3.5176 > 3.2316 , median: 3 = 3



### 6.37 MEDIAN DIST FROM BP TO 3SS UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like DIST FROM MAXBP TO 3SS but median over top-3 predicted BPs



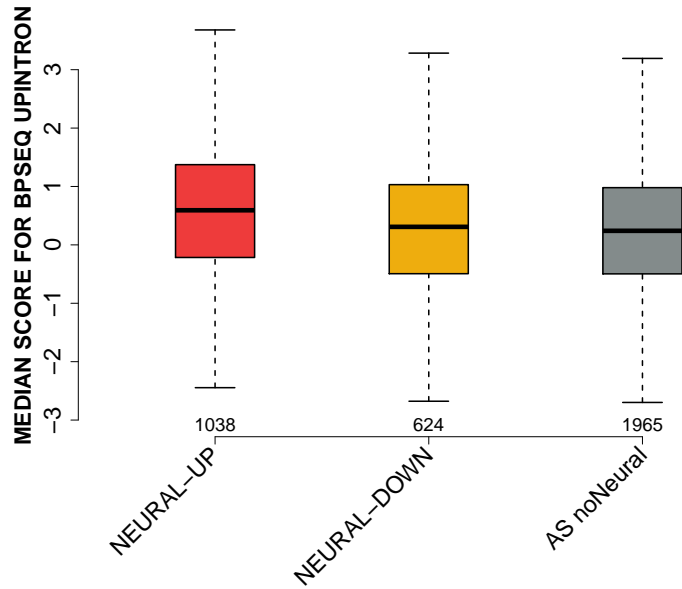
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.0043556  
mean: 68.4461 > 64.8734 , median: 63 > 60.25
- NEURAL-UP vs AS\_noNeural : 4.68978e-07  
mean: 68.4461 > 63.787 , median: 63 > 57

## 6.38 MEDIAN SCORE FOR BPSEQ UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like SCORE FOR MAXBP SEQ but median over top-3 predicted BPs



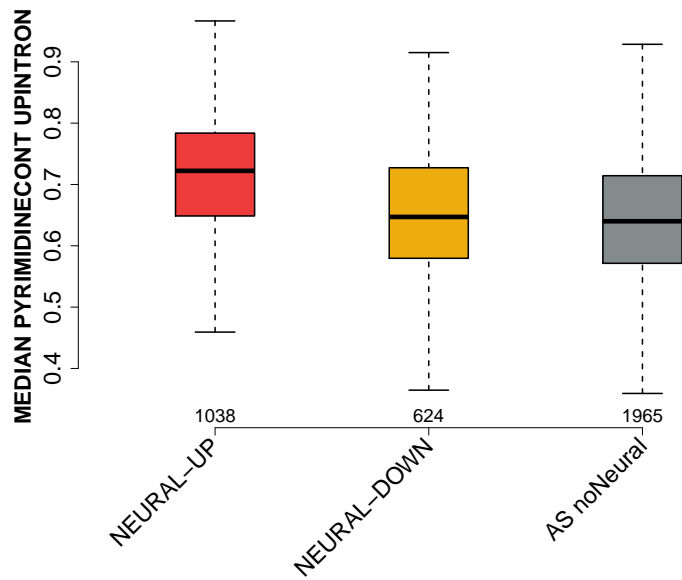
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 4.13922e-07  
mean: 0.605139 > 0.304038 , median: 0.592501 > 0.308634
- NEURAL-UP vs AS\_noNeural : 2.63125e-15  
mean: 0.605139 > 0.234322 , median: 0.592501 > 0.24072

## 6.39 MEDIAN PYRIMIDINECONT UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like PYRIMIDINECONT MAXBP but median over top-3 predicted BPs



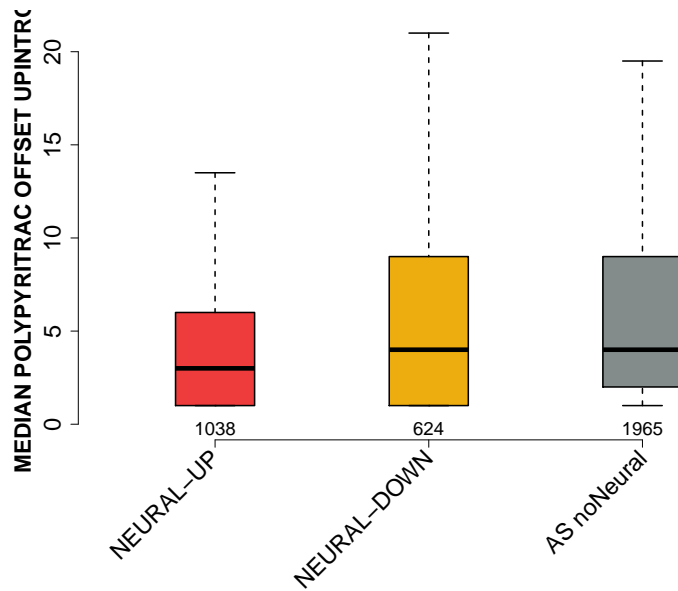
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 2.09635e-31  
mean: 0.71347 > 0.653307 , median: 0.722222 > 0.647059
- NEURAL-UP vs AS\_noNeural : 4.28393e-66  
mean: 0.71347 > 0.646026 , median: 0.722222 > 0.64

## 6.40 MEDIAN POLYPYRITRAC OFFSET UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like POLYPYRITRAC OFFSET MAXBP but median over top-3 predicted BPs



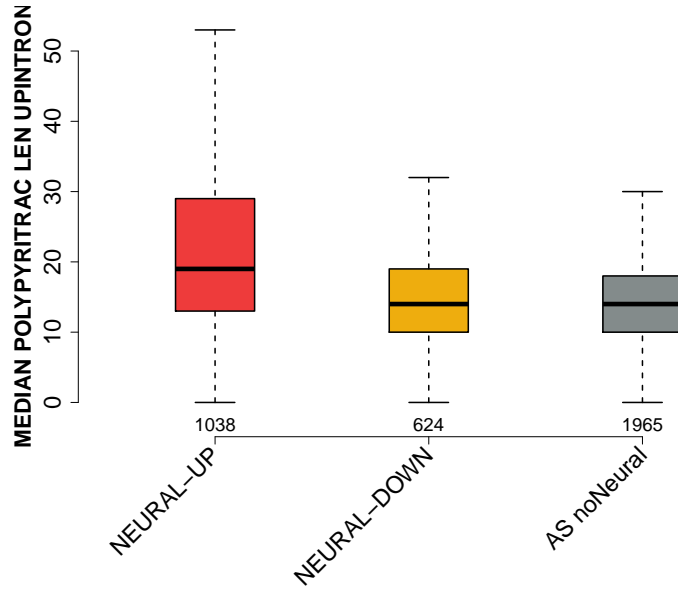
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN :  $9.20215e-08$   
mean:  $4.8512 < 6.5288$  , median:  $3 < 4$
- NEURAL-UP vs AS\_noNeural :  $8.96505e-18$   
mean:  $4.8512 < 7.484$  , median:  $3 < 4$

## 6.41 MEDIAN POLYPYRITRAC LEN UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like POLYPYRITRAC LEN MAXBP but median over top-3 predicted BPs



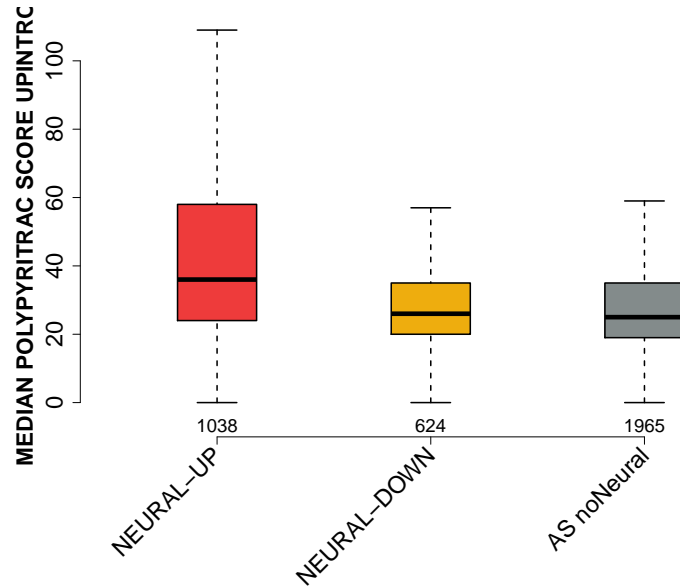
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN :  $1.8505e-26$   
mean:  $24.1002 > 16.472$  , median:  $19 > 14$
- NEURAL-UP vs AS\_noNeural :  $2.99881e-57$   
mean:  $24.1002 > 15.3913$  , median:  $19 > 14$

## 6.42 MEDIAN POLYPYRITRAC SCORE UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like POLYPYRITRAC SCORE MAXBP but median over top-3 predicted BPs



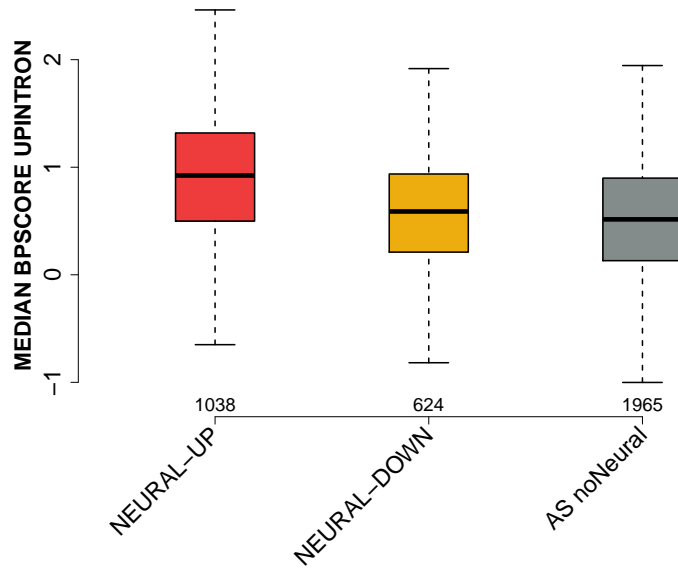
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN :  $1.76495e-27$   
mean: 47.1045 > 30.9928 , median: 36 > 26
- NEURAL-UP vs AS\_noNeural :  $3.97763e-55$   
mean: 47.1045 > 29.5356 , median: 36 > 25

## 6.43 MEDIAN BPScore UPINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like BPScore MAXBP but median over top-3 predicted BPs



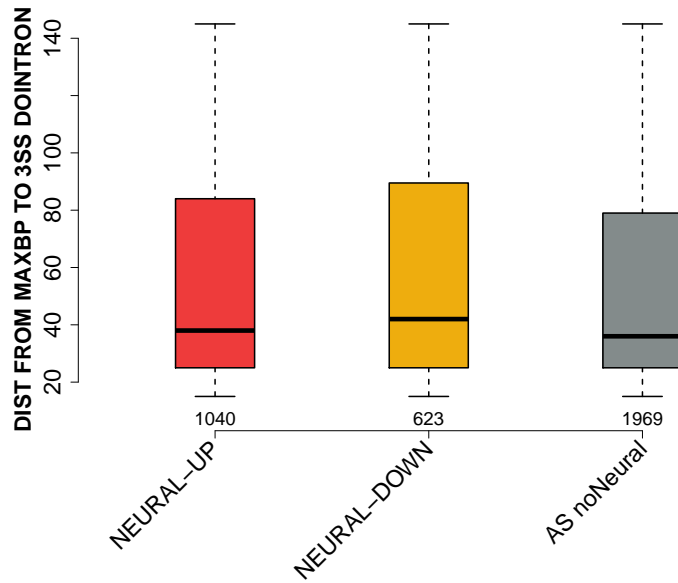
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 2.65618e-27  
mean: 0.892907 > 0.510908 , median: 0.922935 > 0.588547
- NEURAL-UP vs AS\_noNeural : 4.30364e-62  
mean: 0.892907 > 0.409649 , median: 0.922935 > 0.515168
- NEURAL-DOWN vs AS\_noNeural : 0.0147155  
mean: 0.510908 > 0.409649 , median: 0.588547 > 0.515168

## 6.44 DIST FROM MAXBP TO 3SS DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: distance to 3ss of best precited BP



Significant results from Mann-Whitney U test:

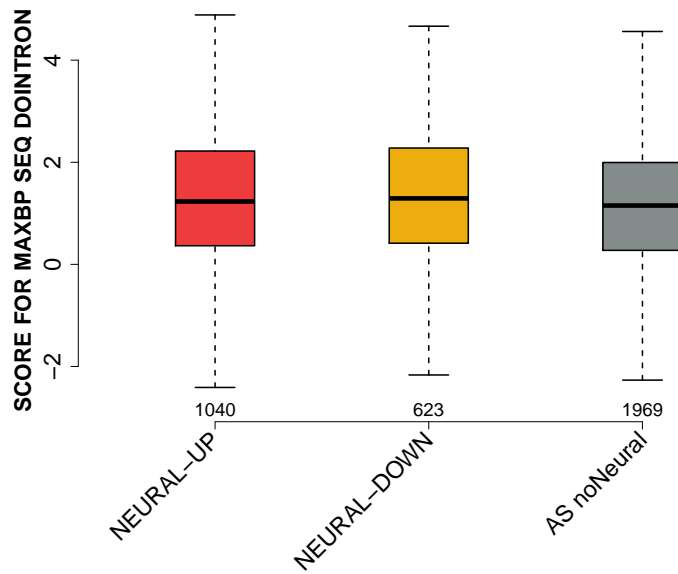
- NEURAL-DOWN vs AS\_noNeural : 0.0324964  
mean: 58.5522 > 54.2595 , median: 42 > 36



## 6.45 SCORE FOR MAXBP SEQ DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: BP sequence score of best predicted BP



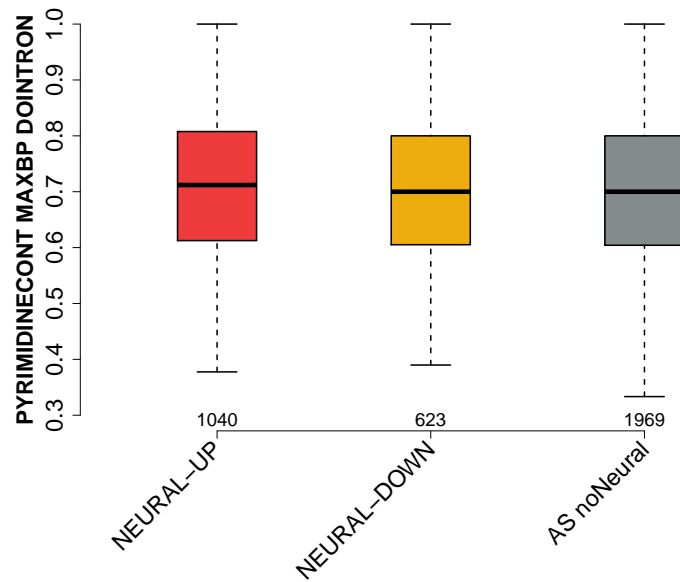
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.0266716  
mean: 1.2726 > 1.1417 , median: 1.2315 > 1.1524
- NEURAL-DOWN vs AS\_noNeural : 0.00314006  
mean: 1.33 > 1.1417 , median: 1.2921 > 1.1524

## 6.46 PYRIMIDINECONT MAXBP DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Pyrimidine content between the BP adenine and the 3 prime splice site for best BP



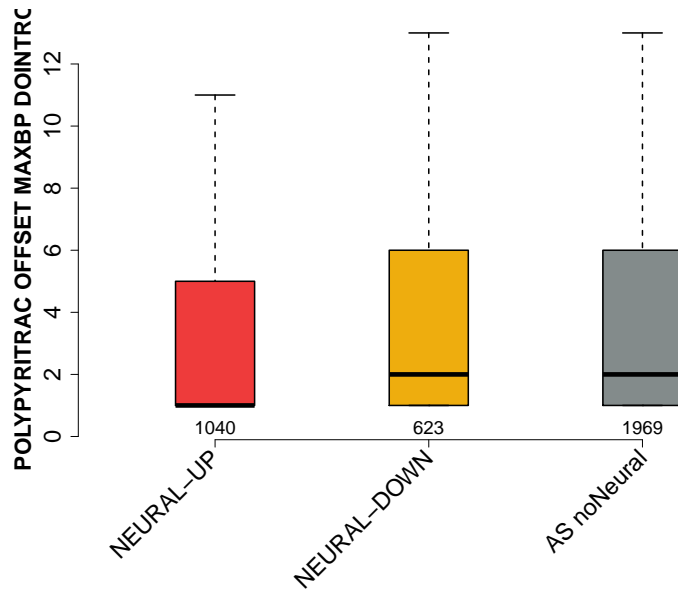
Significant results from Mann-Whitney U test:

- none

## 6.47 POLYPYRITRAC OFFSET MAXBP DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Polypyrimidine track offset relative to the BP adenine for best BP



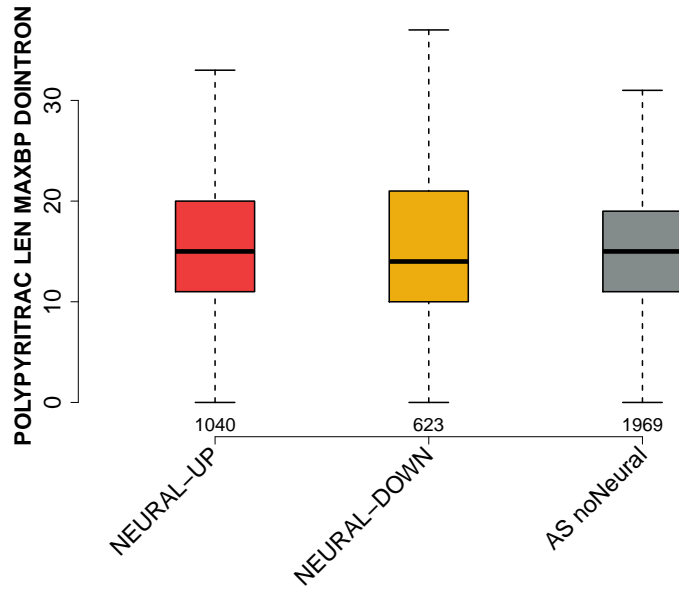
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.0392293  
mean: 3.8769 < 4.6228 , median: 1 < 2
- NEURAL-UP vs AS\_noNeural : 0.00490421  
mean: 3.8769 < 4.4754 , median: 1 < 2

## 6.48 POLYPYRITRAC LEN MAXBP DONTTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Polypyrimidine track length for best BP



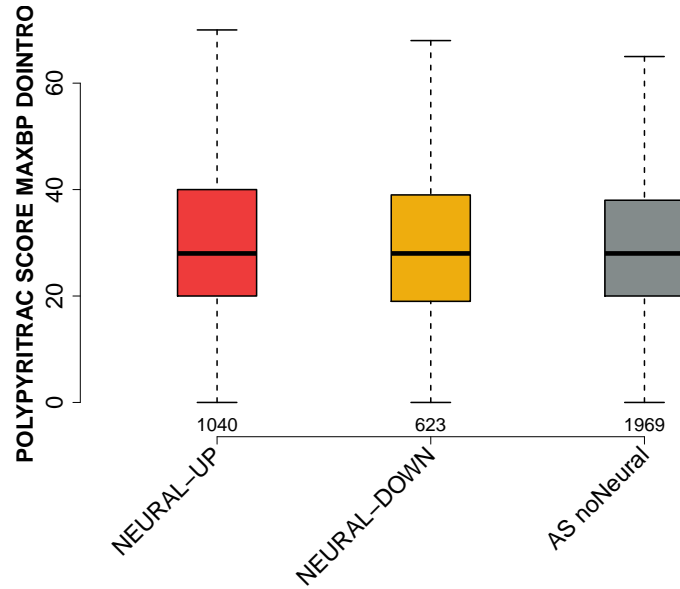
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.0187323  
mean: 17.2865 > 16.0929 , median: 15 = 15

## 6.49 POLYPYRITRAC SCORE MAXBP DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: Polypyrimidine track score for best BP



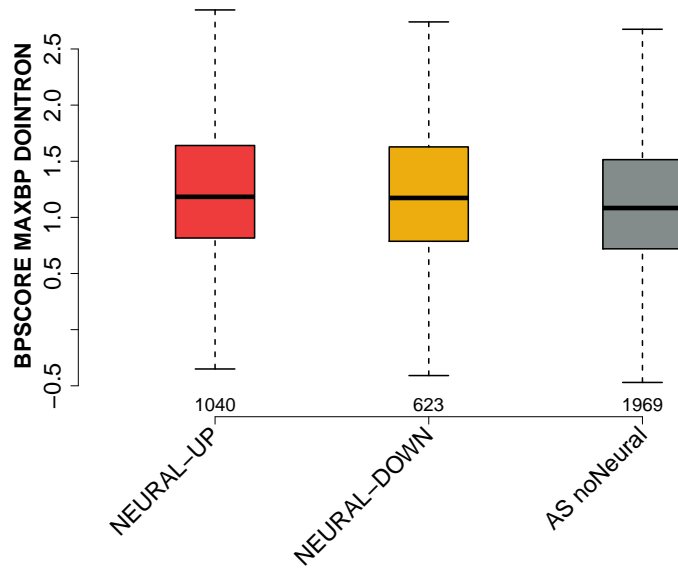
Significant results from Mann-Whitney U test:

- none

## 6.50 BPScore MAXBP DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: SVM classification score of best BP



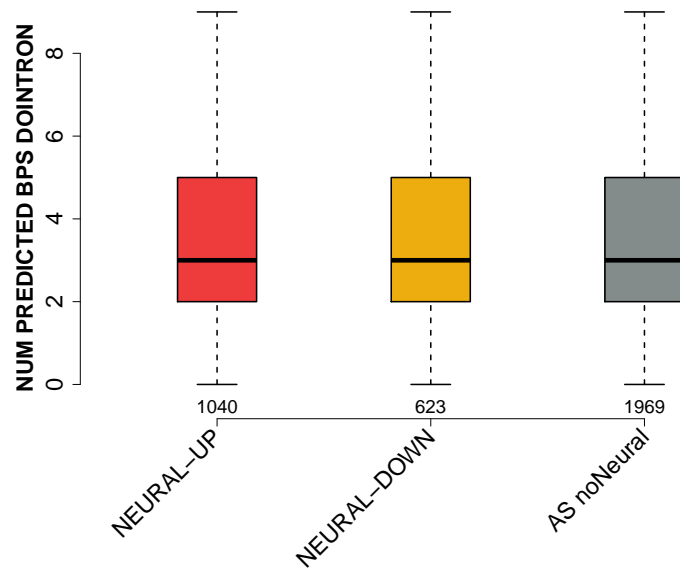
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 6.49099e-06  
mean: 1.1916 > 1.0841 , median: 1.1831 > 1.0832
- NEURAL-DOWN vs AS\_noNeural : 0.00074734  
mean: 1.1631 > 1.0841 , median: 1.1731 > 1.0832

## 6.51 NUM PREDICTED BPS DOWINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: number of all predicted BPs which have a positive BP score



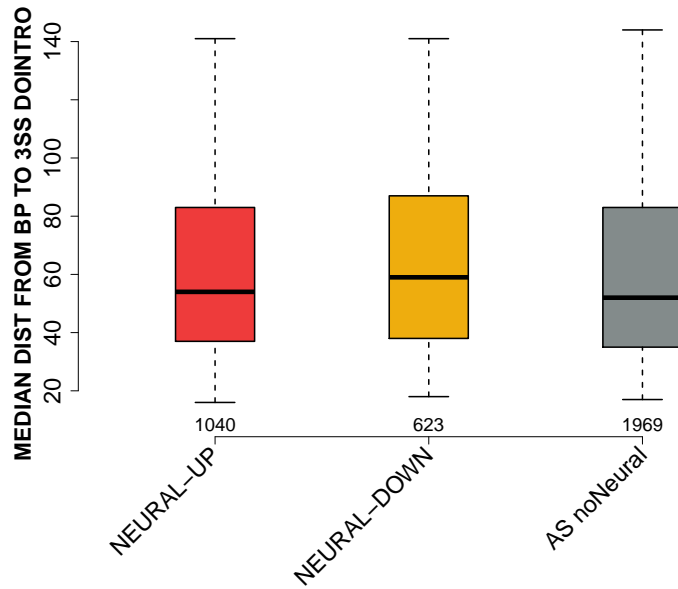
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.011806  
mean: 3.525 > 3.3418 , median: 3 = 3
- NEURAL-DOWN vs AS\_noNeural : 0.0282774  
mean: 3.549 > 3.3418 , median: 3 = 3

## 6.52 MEDIAN DIST FROM BP TO 3SS DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like DIST FROM MAXBP TO 3SS but median over top-3 predicted BPs



Significant results from Mann-Whitney U test:

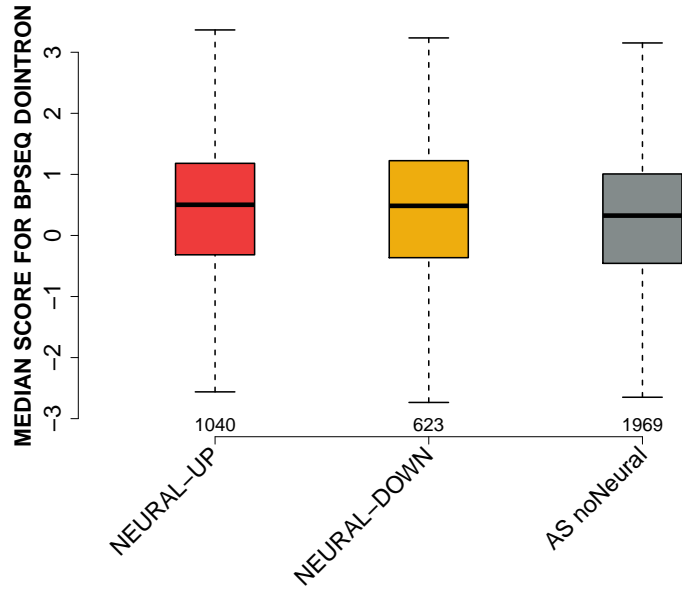
- NEURAL-DOWN vs AS\_noNeural : 0.0132496  
mean: 64.5795 > 61.1943 , median: 59 > 52



## 6.53 MEDIAN SCORE FOR BPSEQ DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like SCORE FOR MAXBP SEQ but median over top-3 predicted BPs



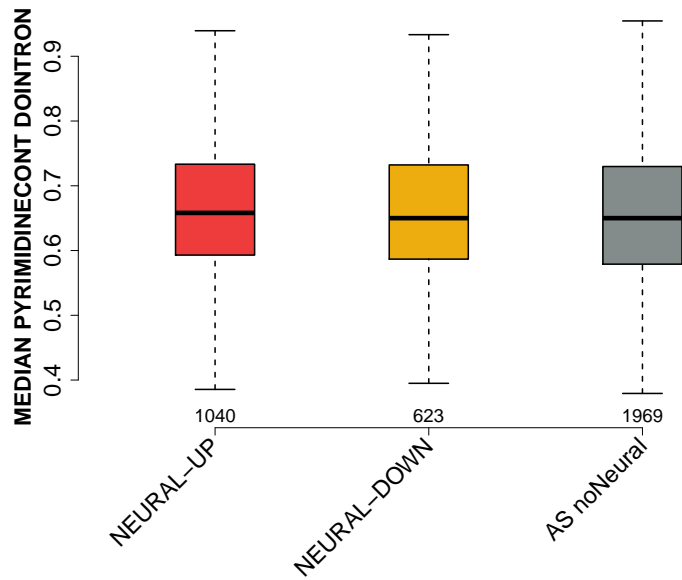
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.000140787  
mean: 0.462276 > 0.305119 , median: 0.502496 > 0.325203
- NEURAL-DOWN vs AS\_noNeural : 0.00834558  
mean: 0.435661 > 0.305119 , median: 0.48498 > 0.325203

## 6.54 MEDIAN PYRIMIDINECONT DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like PYRIMIDINECONT MAXBP but median over top-3 predicted BPs



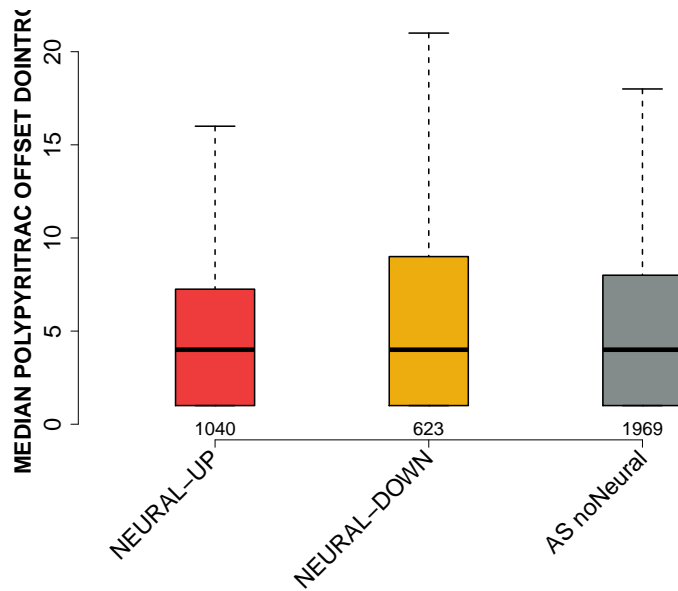
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.0295066  
mean: 0.663495 > 0.655661 , median: 0.658114 > 0.65

## 6.55 MEDIAN POLYPYRITRAC OFFSET DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like POLYPYRITRAC OFFSET MAXBP but median over top-3 predicted BPs



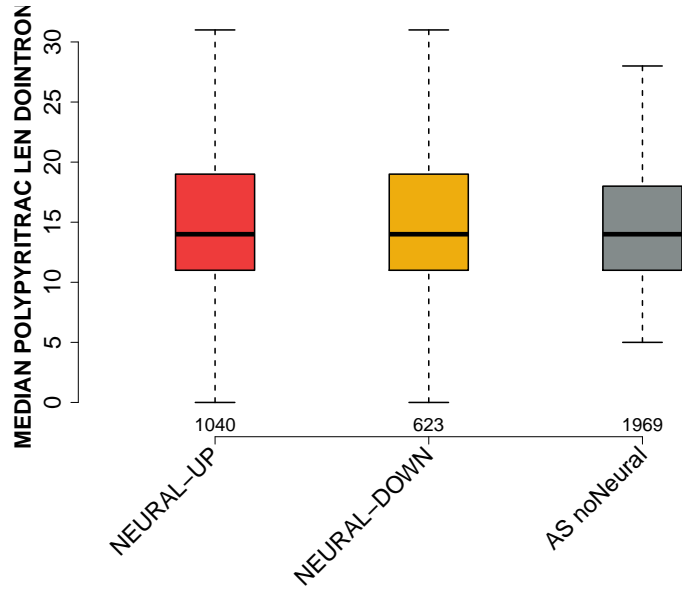
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.0370834  
mean: 6.313 < 6.9787 , median: 4 = 4

## 6.56 MEDIAN POLYPYRITRAC LEN DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like POLYPYRITRAC LEN MAXBP but median over top-3 predicted BPs



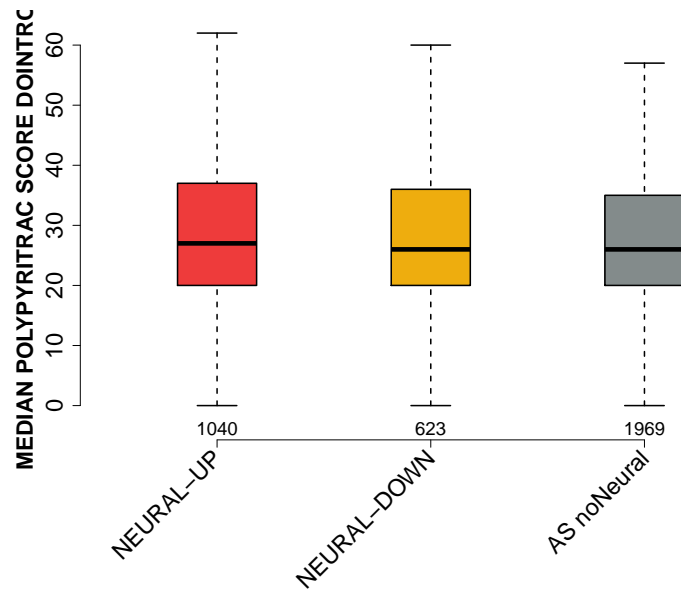
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.00652018  
mean: 16.3313 > 15.3029 , median: 14 = 14

## 6.57 MEDIAN POLYPYRITRAC SCORE DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like POLYPYRITRAC SCORE MAXBP but median over top-3 predicted BPs



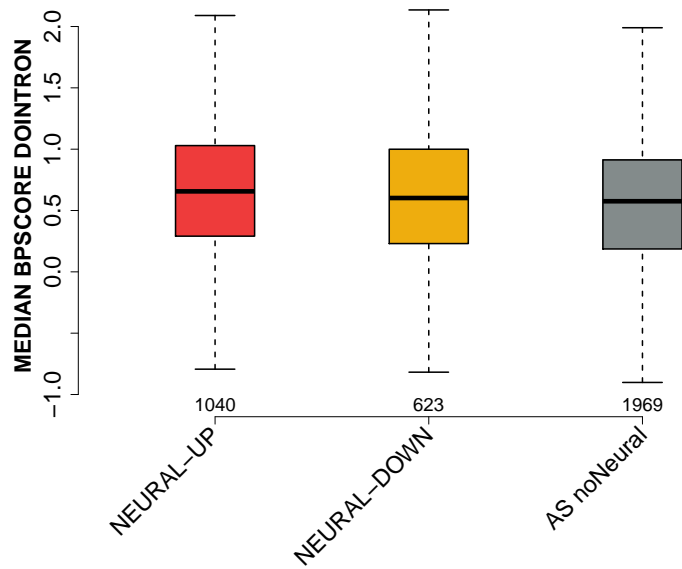
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.0300928  
mean: 31.0707 > 29.3636 , median: 27 > 26

## 6.58 MEDIAN BPScore DOINTRON

Back to: [Overview](#) | [ToC](#)

Meaning: like BPScore MAXBP but median over top-3 predicted BPs



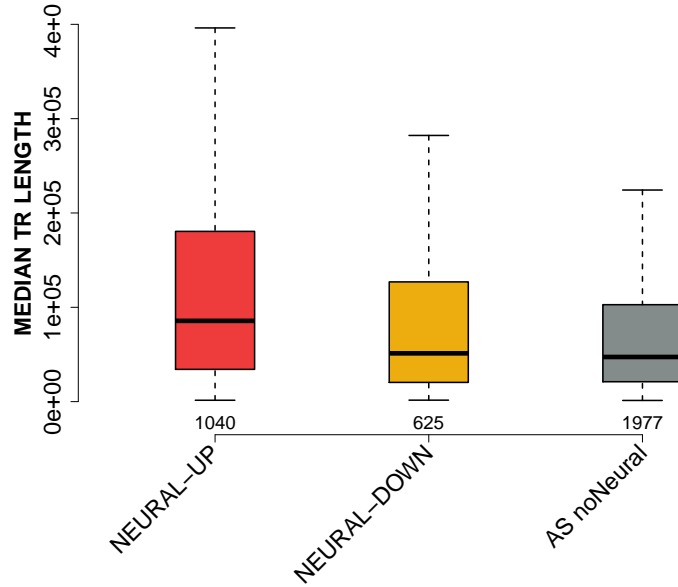
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 5.24953e-06  
mean: 0.595363 > 0.473238 , median: 0.656153 > 0.575544
- NEURAL-DOWN vs AS\_noNeural : 0.0246896  
mean: 0.548643 > 0.473238 , median: 0.601876 > 0.575544

## 6.59 MEDIAN TR LENGTH

Back to: [Overview](#) | [ToC](#)

Meaning: median length of transcripts the exon occurs in



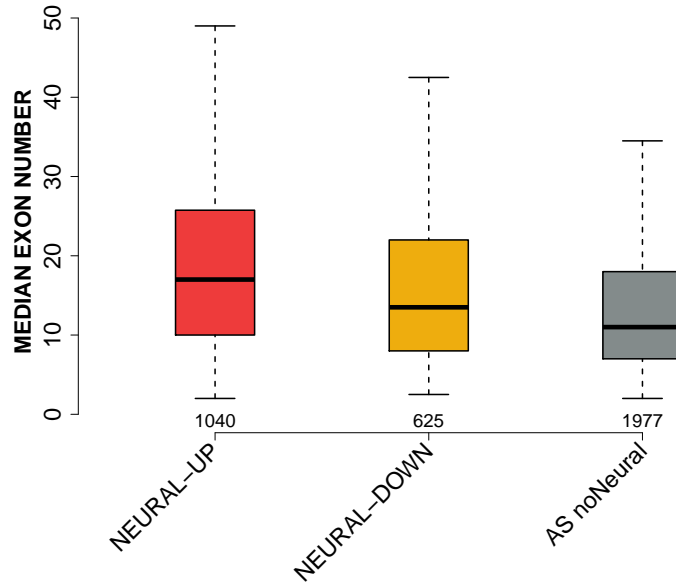
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 1.14316e-12  
mean: 137448.6688 > 98821.1208 , median: 85623.5 > 51200.5
- NEURAL-UP vs AS\_noNeural : 2.36567e-33  
mean: 137448.6688 > 83660.8892 , median: 85623.5 > 47324

## 6.60 MEDIAN EXON NUMBER

Back to: [Overview](#) | [ToC](#)

Meaning: ... of transcripts where exon was found in



Significant results from Mann-Whitney U test:

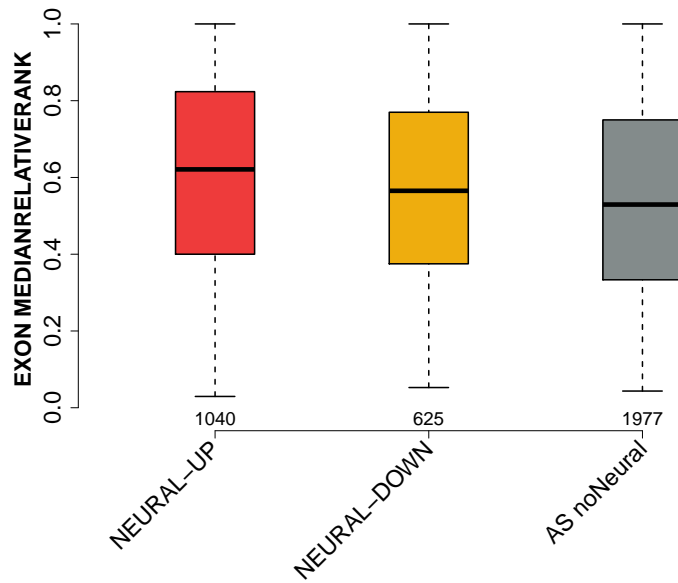
- NEURAL-UP vs NEURAL-DOWN : 7.88074e-07  
mean: 19.5255 > 17.8968 , median: 17 > 13.5
- NEURAL-UP vs AS\_noNeural : 1.26792e-46  
mean: 19.5255 > 13.8187 , median: 17 > 11
- NEURAL-DOWN vs AS\_noNeural : 3.40578e-11  
mean: 17.8968 > 13.8187 , median: 13.5 > 11



## 6.61 EXON MEDIANRELATIVERANK

Back to: [Overview](#) | [ToC](#)

Meaning: relative rank = rank / number of all exons in transcript, is between 0 and 1



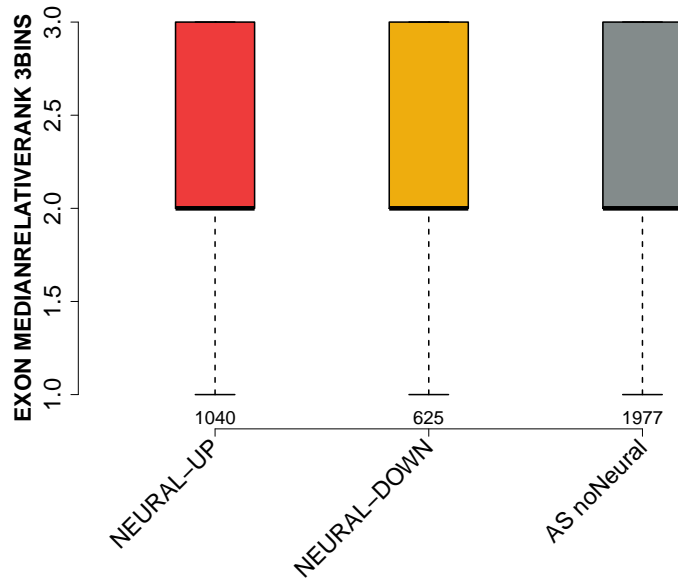
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.000689967  
mean: 0.609477 > 0.567223 , median: 0.621017 > 0.565217
- NEURAL-UP vs AS\_noNeural : 3.3297e-12  
mean: 0.609477 > 0.540066 , median: 0.621017 > 0.529412
- NEURAL-DOWN vs AS\_noNeural : 0.0188046  
mean: 0.567223 > 0.540066 , median: 0.565217 > 0.529412

## 6.62 EXON MEDIANRELATIVERANK 3BINS

Back to: [Overview](#) | [ToC](#)

Meaning: median bin into which EXON MEDIANRELATIVERANK falls when binning 0-1 into 3 bins



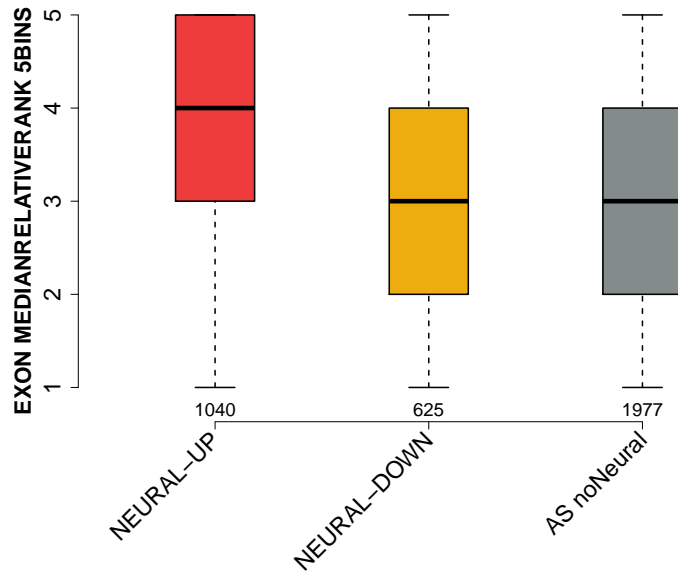
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00676211  
mean: 2.301 > 2.2048 , median: 2 = 2
- NEURAL-UP vs AS\_noNeural : 4.89978e-09  
mean: 2.301 > 2.127 , median: 2 = 2
- NEURAL-DOWN vs AS\_noNeural : 0.0383599  
mean: 2.2048 > 2.127 , median: 2 = 2

## 6.63 EXON MEDIANRELATIVERANK 5BINS

Back to: [Overview](#) | [ToC](#)

Meaning: similar to EXON MEDIANRELATIVERANK 3BINS with 5 bins



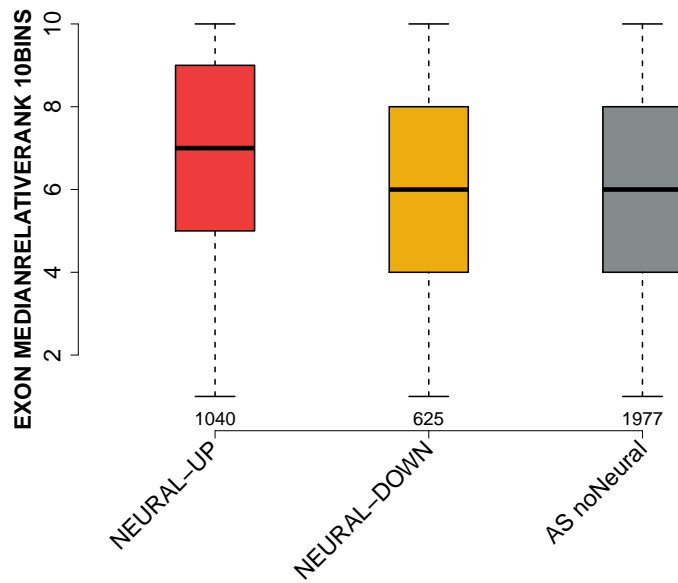
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00142345  
mean: 3.5212 > 3.3312 , median: 4 > 3
- NEURAL-UP vs AS\_noNeural : 5.16207e-11  
mean: 3.5212 > 3.1988 , median: 4 > 3
- NEURAL-DOWN vs AS\_noNeural : 0.0260211  
mean: 3.3312 > 3.1988 , median: 3 = 3

## 6.64 EXON MEDIANRELATIVERANK 10BINS

Back to: [Overview](#) | [ToC](#)

Meaning: similar to EXON MEDIANRELATIVERANK 3BINS with 10 bins



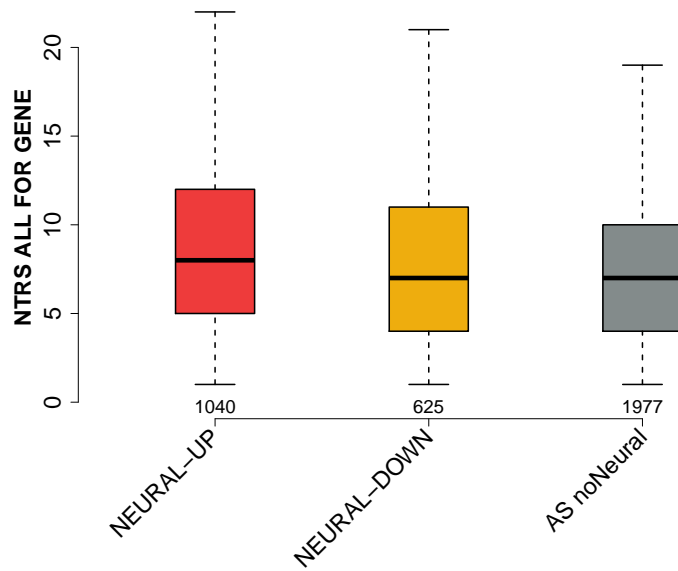
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00112175  
mean: 6.5846 > 6.1952 , median: 7 > 6
- NEURAL-UP vs AS\_noNeural : 1.0093e-11  
mean: 6.5846 > 5.917 , median: 7 > 6
- NEURAL-DOWN vs AS\_noNeural : 0.0200926  
mean: 6.1952 > 5.917 , median: 6 = 6

## 6.65 NTRS ALL FOR GENE

Back to: [Overview](#) | [ToC](#)

Meaning: number of transcripts of gene where the exon was found in



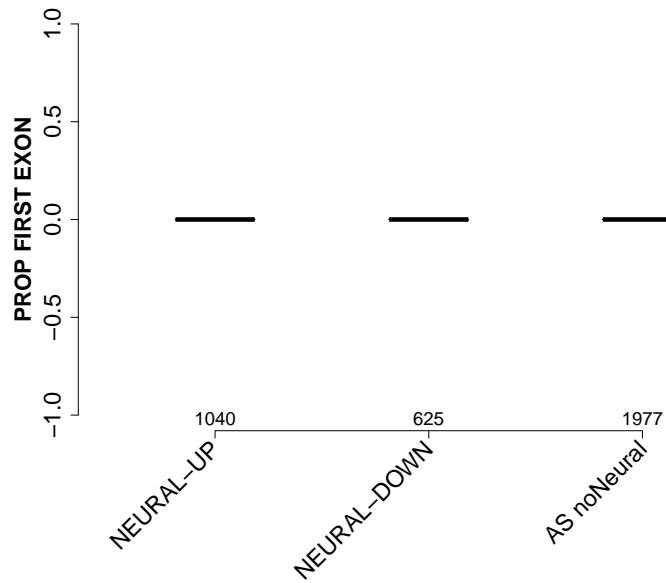
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00139747  
mean: 9.351 > 8.7856 , median: 8 > 7
- NEURAL-UP vs AS\_noNeural : 3.11637e-16  
mean: 9.351 > 7.6247 , median: 8 > 7
- NEURAL-DOWN vs AS\_noNeural : 0.000961788  
mean: 8.7856 > 7.6247 , median: 7 = 7

## 6.66 PROP FIRST EXON

Back to: [Overview](#) | [ToC](#)

Meaning: NTRS WITH EXON AS FIRST EXON / NTRS WITH EXON



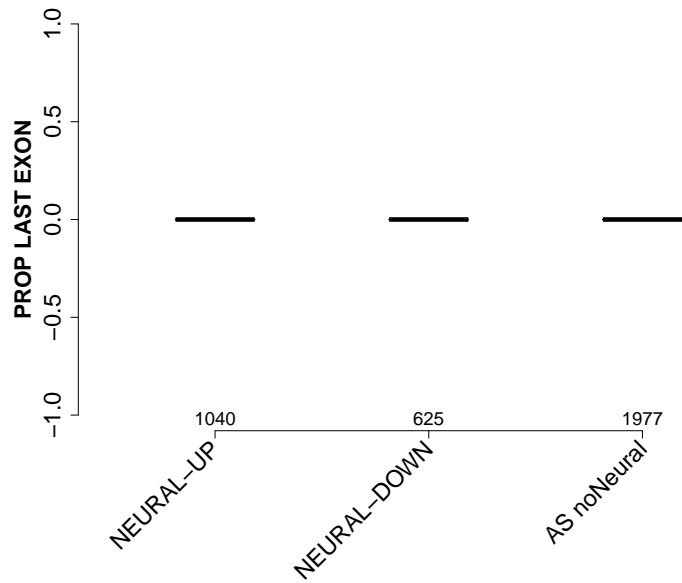
Significant results from Mann-Whitney U test:

- NEURAL-UP vs AS\_noNeural : 0.031902  
mean: 0.0152717 < 0.0207862 , median: 0 = 0

## 6.67 PROP LAST EXON

Back to: [Overview](#) | [ToC](#)

Meaning: NTRS WITH EXON AS LAST EXON / NTRS WITH EXON



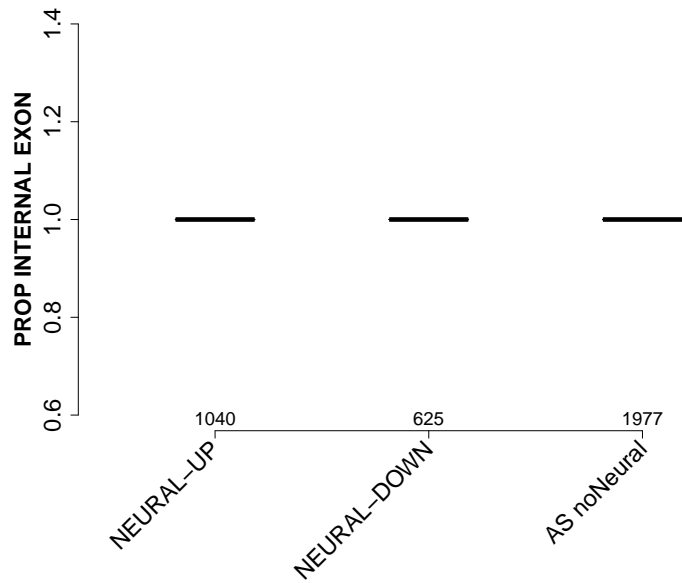
Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 8.838e-05  
mean: 0.0148016 < 0.0296525 , median: 0 = 0
- NEURAL-UP vs AS\_noNeural : 0.000335829  
mean: 0.0148016 < 0.0251772 , median: 0 = 0

## 6.68 PROP INTERNAL EXON

Back to: [Overview](#) | [ToC](#)

Meaning: NTRS WITH EXON AS INTERNAL EXON / NTRS WITH EXON



Significant results from Mann-Whitney U test:

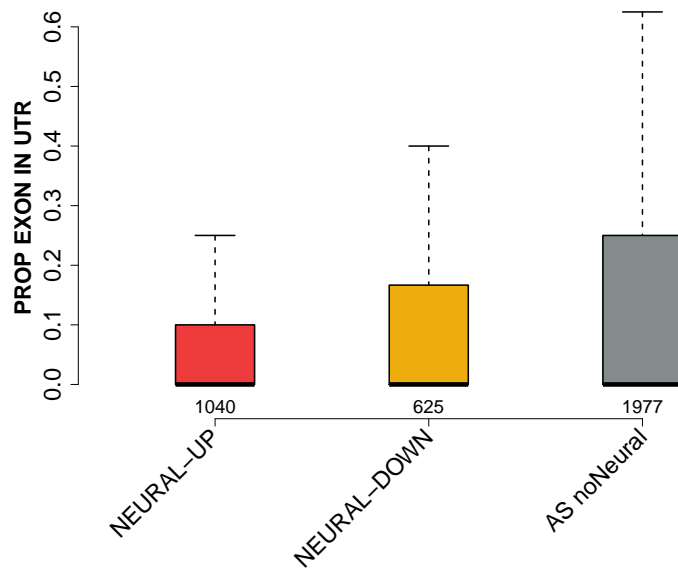
- NEURAL-UP vs NEURAL-DOWN : 5.06498e-05  
mean: 0.969927 > 0.952204 , median: 1 = 1
- NEURAL-UP vs AS\_noNeural : 2.55529e-05  
mean: 0.969927 > 0.9541 , median: 1 = 1



## 6.69 PROP EXON IN UTR

Back to: [Overview](#) | [ToC](#)

Meaning: NTRS WITH EXON IN UTR / NTRS WITH EXON



Significant results from Mann-Whitney U test:

- NEURAL-UP vs NEURAL-DOWN : 0.00878402  
mean: 0.0811766 < 0.117622 , median: 0 = 0
- NEURAL-UP vs AS\_noNeural : 5.77523e-16  
mean: 0.0811766 < 0.147753 , median: 0 = 0
- NEURAL-DOWN vs AS\_noNeural : 0.000141067  
mean: 0.117622 < 0.147753 , median: 0 = 0