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Introduction

Sue and Bill Gross Stem Cell Research Center @ UCI School of Medicine

- Spinal Cord Injury
- Ladder Beam
- Catwalk

Primary Objectives:

- Evaluate effectiveness of treatments for SCI
- Classifying (tracking) mice steps

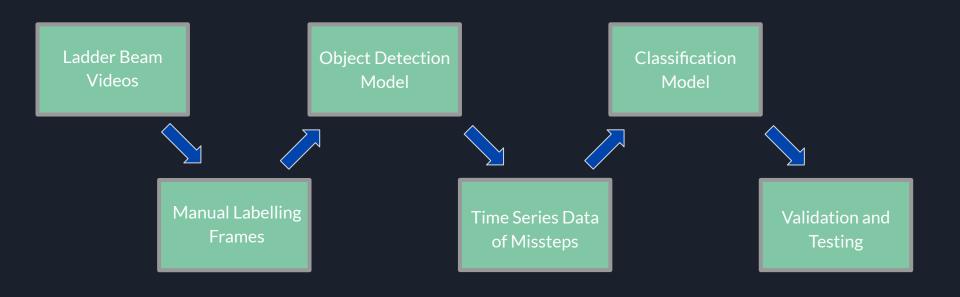
Data Source:

- Ladder Beam Videos
- Summary Excel Sheets

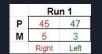




Data Pipeline



Raw Data: Individual Mice and Ladder Beam Clip





29 M P 28 28 P P 28 27 M P 27 26 P P 26 25 M P 25 24 P P 24 23 P P 23 22 P P 22 21 P P 21	Pink	50	P	Р	50
AT		49		М	49
A		48			48
A		47	Р	Р	47
44 M P 44 43 P M 42 44 P P M 43 42 P P 42 44 P P 42 45 P P 42 46 P P 42 47 P P 49 48 P P 39 48 P P 36 49 P P 37 40 P P 36		46	P	P	46
44 M P 44 43 P M 42 44 P P M 43 42 P P 42 44 P P 42 45 P P 42 46 P P 42 47 P P 49 48 P P 39 48 P P 36 49 P P 37 40 P P 36		45	Р	Р	45
A		44	M	Р	44
A P P P 41 Blue 40 P P 40 38 P P P 39 37 P P P 37 36 P P P 36 37 P P P 37 36 P P P 36 37 P P P 37 36 P P P 36 37 P P P 37 38 P P P 36 38 P P P 32 39 P P P 32 40 P P P 32 40 P P P 32 40 P P P 30 50 P P 30 50 P P 30 50 P P		43	P	M	43
Blue 40 P P 40 39 P P 38 38 P P P 38 37 P P 36 36 P P P 36 34 P P P 36 34 P P P 36 34 P P P 36 32 P P P 37 32 P P P 37 32 P P P 37 34 P P P 36 35 P P P 36 36 P P P 36 36 P P P 36 37 P P P 37 38 P P P 36 39 P P P 36 30 P P P 36 30 P P P 36 30 P P P 36 31 P P P 36 32 P P P 36 33 P P P 36 34 P P P 36 35 P P P 36 36 P P P 36 37 P P 16 38 P P 16 39 P P 16 40 P P 16 41 P P P 16 42 P P P 16 43 P P P 16 44 P P P 16 46 P P P 16 47 P P 17 48 P P P 16 49 P P 16 40 P P 16 40 P P 16 41 P P P 16 41 P P P 16 42 P P P 16 44 P P P 16 46 P P P 16 47 P P P 16 48 P P P 16 49 P P P 16 40 P P P 16 40 P P P 16 41 P P P 16 42 P P P 16 44 P P P 16 45 P P P 16 46 P P P 16 47 P P P 16 48 P P P 16 49 P P P 16 40 P P P 16 41 P P P 16 41 P P P 16 42 P P P 16 44 P P P P 16 45 P P P 16 46 P P P 16 47 P P P 16 48 P P P 16 49 P P P 16 40 P P		42	P	Р	42
39		41	P	P	
39	Blue	40	Р	Р	40
38			P	Р	39
36		38	P	Р	38
36		37	P	Р	37
34 P P 34 33 P P 33 32 P P 32 31 P P 30 31 P P 9 30 32 P P P 30 31 P P 9 30 32 P P 20 33 P P 20 34 P P 20 35 P P 20 36 P P 20 36 P P 20 37 M P 25 38 P P 20 38 P P 20 39 P P 20 39 P P 20 31 P P 20 31 P P 20 31 P P 20 32 P P P 20 33 P P P 10 34 P P 11 35 P P 11 36 P P 11 37 P P 11 38 P P 11 39 P P 11 30 P P 11 31 P P 11 32 P P 9 34 P P 9 36 P P 9 37 P P 9 38 P P 9 39 P P 9 30 P P 9 30 P P 9 31 P P 10 31 P P P 10			P	Р	36
33 P P 33 34 P P 35 35 P P 36 36 9 9 36 9 9 9 36 9 9 9 9 9 9 9 9 9		35	P	P	35
32		34	P	P	34
31		33	P	P	
Yellow No P P 30 P 30 P		32	P	P	
Yellow No P P 30 P 30 P			P	Р	31
28 P P 28 27 M P 27 28 P P P 28 28 P P P 26 28 P P P 26 29 P P 26 24 P P P 25 24 P P P 25 25 P P P 26 26 P P P 26 27 P P 27 28 P P P 27 29 P P 29 29 P P 29 20 P P 20 20 P P 20 20 P P 20 21 P P P 19 21 P P 19 22 P P P 11 23 P P 11 24 P P 11 25 P P 15 26 P P 15 27 P P 17 28 P P 18 28 P P 18 29 P P 19 20 P P 19 20 P P 10 21 P P 11 22 P P P 12 23 P P P 15 24 P P P 15 25 P P P 5 26 P P P 5 26 P P P 5 26 P P P 5 27 P P P 7 28 P P 8 28 P P 8 29 P P 8 20 P P P 9 20 P P P P P 9 20 P P P P P P P P P P P P P P P P P P P	Yellow	30	P	Р	30
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26 P P 26 25 M P 26 26 P P 24 27 P P 24 28 P P P 24 29 P P 20 20 P P 20 20 P P 20 20 P P 20 20 P P 20 21 P P P 19 31 M M 18 31 P P 16 31 P P 17 40 P P 16 41 P P P 16 51 P P 16		28		P	28
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19		21	P	Р	
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Red 10 P P 17 P P 16 P 17 P 17 P P 16 P 17 P 17			P	P	
15 P P 15 14 P P 14 13 P P 13 12 P P 12 13 P P 13 14 P P 14 15 P P 15 16 P P 16 17 P P 17 18 P P 18 19 P P 19 19 P P 19 10 P P 19 10 P P 19 11 P P 19 12 P P 19 13 P P 19 14 P P 19 15 P P 19 16 P P 19 17 P 19 18 P P 19 19 P 19 10 P P 10 P				M	
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7 P P 7 6 P P 6 5 P P 5 4 P P 4 3 P P 3 2 P P 2 Green 1 P P 1				P	
6 P P 6 5 P P 5 4 P P 4 3 P P 3 P P 3 2 P P 2 Green 1 P P 1				P	
5 P P 5 4 P P 4 3 P P 3 2 P P 2 Green 1 P P 1					
3 P P 3 2 P P 2 Green 1 P P 1				P P	
3 P P 3 2 P P 2 Green 1 P P 1			1	P P	
2 P P 2 Green 1 P P 1			F-	2	
Green 1 P P 1			1	P P	
			P P	P D	
Right Left	Green	1			1
			rxight	Lett	

Raw Data: Summary Data

Project	A111.1										
Analyzer											
Day Post Injury							Cumulative Error	For Sided Inju	ries		
							Same as Total Bad (L+R, 3 run	s)			
	Animal	Total Good (L+R, 3 runs)	Total Bad (L + R, 3 runs)	Ave Good	Ave Bad	LB Score	CE	Ave L Good	Ave R Good	Ave L Bad	Ave R Bad
	1	276.0	24.0	46.0	4.0	92.0	24.0	46.0	46.0	4.0	4.0
	2	280.0	20.0	46.7	3.3	93.3	20.0	48.0	45.3	2.0	4.7
	3	255.0	45.0	42.5	7.5	85.0	45.0	40.0	45.0	10.0	5.0
	4	228.0	71.0	38.0	11.8	76.3	71.0	37.0	39.0	13.0	10.7
	5	267.0	33.0	44.5	5.5	89.0	33.0	45.0	44.0	5.0	6.0
	6	279.0	21.0	46.5	3.5	93.0	21.0	45.7	47.3	4.3	2.7
	7	276.0	24.0	46.0	4.0	92.0	24.0	46.7	45.3	3.3	4.7
	8	226.0	74.0	37.7	12.3	75.3	74.0	38.3	37.0	11.7	13.0
	9	227.0	73.0	37.8	12.2	75.7	73.0	39.7	36.0	10.3	14.0
	10(11)	222.0	78.0	37.0	13.0	74.0	78.0	36.7	37.3	13.3	12.7
	10*(10)	252.0	48.0	42.0	8.0	84.0	48.0	42.0	42.0	8.0	8.0
	12	247.0	53.0	41.2	8.8	82.3	53.0	38.7	43.7	11.3	6.3
	14	251.0	49.0	41.8	8.2	83.7	49.0	42.0	41.7	8.0	8.3
	15	277.0	23.0	46.2	3.8	92.3	23.0	43.3	49.0	6.7	1.0
	16	275.0	25.0	45.8	4.2	91.7	25.0	43.0	48.7	7.0	1.3
	17	217.0	83.0	36.2	13.8	72.3	83.0	37.7	34.7	12.3	15.3
	18	271.0	29.0	45.2	4.8	90.3	29.0	45.7	44.7	4.3	5.3
	19	285.0	15.0	47.5	2.5	95.0	15.0	46.3	48.7	3.7	1.3
	21	253.0	47.0	42.2	7.8	84.3	47.0	36.3	48.0	13.7	2.0
	22	283.0	17.0	47.16666667	2.8	94.3	17	49.0	45.3	1.0	4.7
	23	255.0	45.0	42.5	7.5	85.0	45	40.7	44.3	9.3	5.7
	24	273.0	27.0	45.5	4.5	91.0	27	45.3	45.7	4.7	4.3
	25	281.0	19.0	46.83333333	3.2	93.7	19	45.3	48.3	4.7	1.7
	26	219.0	81.0	36.5	13.5	73.0	81	38.0	35.0	12.0	15.0
	27	291.0	9.0	48.5	1.5	97.0	9	49.3	47.7	0.7	2.3
	28	248.0	52.0	41.33333333	8.7	82.7	52	41.3	41.3	8.7	8.7
	29	237.0	61.0	39.5	10.2	79.5	61	41.7	37.3	7.7	12.7
	30	263.0	36.0	43.83333333	6.0	88.0	36	41.7	46.0	8.0	4.0
	31	263.0	37.0	43.83333333	6.2	87.7	37	44.3	43.3	5.7	6.7
	32	232.0	68.0	38.66666667	11.3	77.3	68	35.7	41.7	14.3	8.3

Variable	Description
Animal ID (int)	The mouse's unique ID number
Type (factor)	The group the mice belongs to (Wild, CD44 Knock-out, Vehicle)
Avg Good (double)	Average number of good steps (plantar steps) across the mouse's three runs
Avg Bad (double)	Average number of bad steps (missteps) across the mouse's three runs

Data Cleaning



Summary Sheet

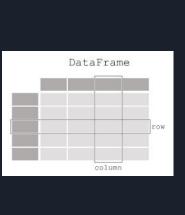
- Extracting necessary columns

Individual Mice Sheets

- Combining misstep information from each mouse

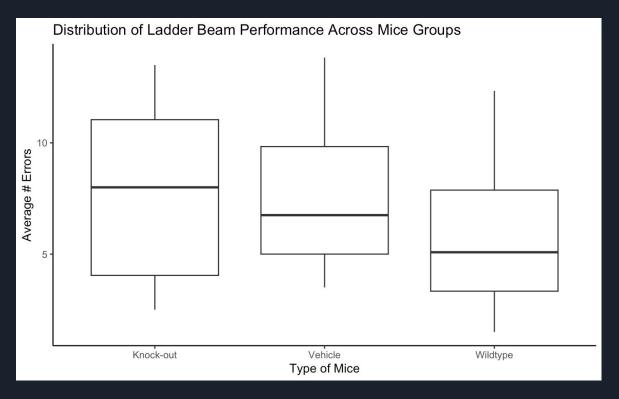
Video Data

- Manually labeling ladder rungs and mouse paws



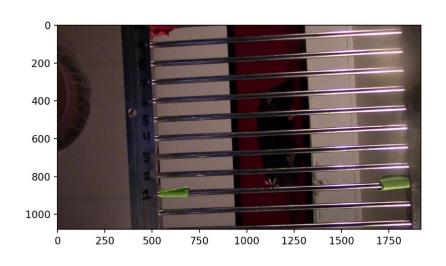
	20			
	49	Р	Р	49
	48	P	P	48
	47	Р	P	47
	46	Р	P	46
	45	P	Р	45
	44	P	P	44
	43	P	P	43
	42	P	P	42
	41	P	P	41
Blue	40	P	Р	40
Ditte	39	P	P	39
	38	P	P	38
	37	P	P	37
	36	P	P	36
	35	P	P	35
	34	P	P	34
		P		
	33		P	33
	32	P	Р	32
	31	P	Р	31
Yellow	30	P	Р	30
	29	P	Р	29
	28	Р	Р	28
	27	Р	Р	27
	26	Р	Р	26
	25	Р	Р	25
	24	Р	Р	24
	23	Р	Р	23
	22	Р	Р	22
	21	Р	Р	21
Orange	20	Р	Р	20
	19	Р	Р	19
	18	Р	Р	18
	17	Р	Р	17
	16	Р	Р	16
	15	Р	Р	15
	14	P	Р	14
	13	Р	Р	13
	12	Р	Р	12
	11	Р	Р	11
Red	10	Р	Р	10
	9	Р	Р	9
	8	Р	Р	8
	7	Р	Р	7
	6	Р	Р	6
	5	Р	Р	5
	4	Р	Р	4
	3	Р	Р	3
	2	Р	Р	2
Green	1	Р	P	1
		Right	Left	
Analyzer Animal II	1#		1	
animiai IL	Jff			1

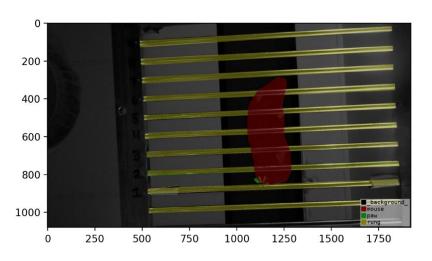
Mice Performance By Groups



Example of Labeled Frame

LabelMe Tool





Next Steps

Completing: Data wrangling and exploratory data analysis

Next: Begin Model Development

- Finish labelling
- Initial Object Tracking Model
- ANOVA
- Tukey's T-test
- Pairwise T-tests

Milestones

Winter:

Weeks 8 to 10

Finalize project goal and data wrangling

Spring:

Weeks 1 to 2

Exploratory Data
Analysis



Weeks 3 to 4

Initial Model Development



Weeks 9 to 10

Project write-up and presentation



Weeks 7 to 8

Model Evaluation and Testing



Weeks 5 to 6

Incorporating ML Algorithms