

Background

- Prolonged standing has been linked with
 - musculoskeletal pain in the lower extremities
 - preterm birth
 - dizziness
 - varicose veins
 - high blood pressure
- Lack of dynamic movement for even just 30 minutes can lead to discomfort; the mean surgery time is 178 minutes
- Some current methods of intervention include
 - intermittent sitting
 - changing shoe/ floor conditions
 - posture adjustments

Methods

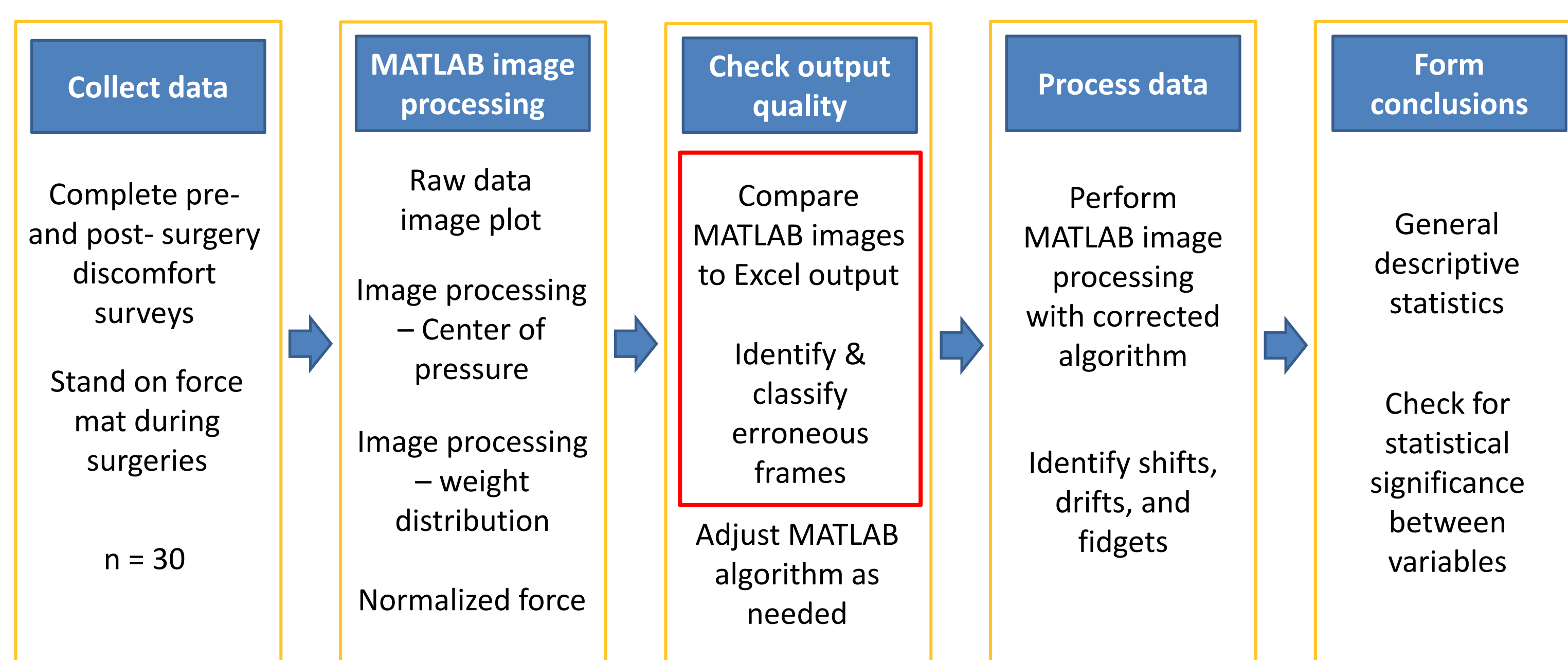


Fig. 1 Analysis procedure of surgeon standing patterns

Data Collection

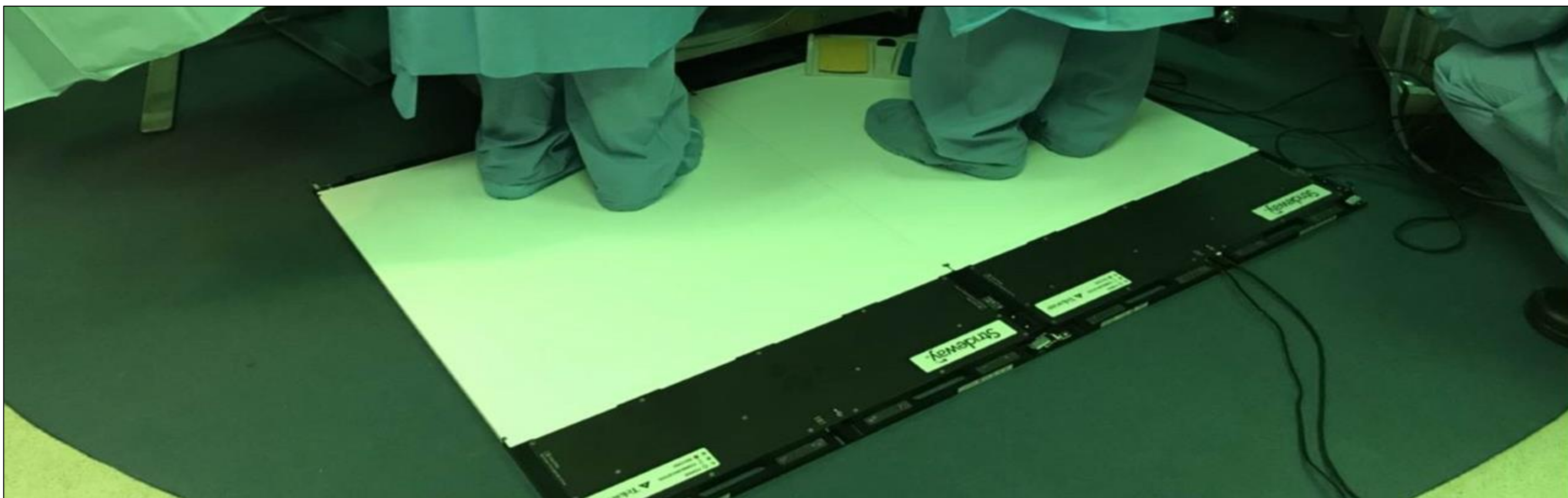


Fig. 2 A force mat was used to collect standing pattern data

Results

Frame classification	Case A		Case B		Case C	
	# of frames	% of frames	# of frames	% of frames	# of frames	% of frames
Meaningful data	9574	30.98%	4863	46.31%	8652	23.90%
Blank lines	10524	34.06%	1166	11.10%	10783	29.79%
Errors	10802	34.96%	4471	42.58%	16765	46.31%
TOTAL FRAMES	30900		10500		36200	

Table 1 Frame classifications for 3 cases

Error classification	Case A		Case B		Case C	
	# of frames	% of frames	# of frames	% of frame	# of frames	% of frames
Error 1 - left identified as right	0	0.00%	704	6.70%	2079	5.74%
Error 2 - right identified as left	46	0.15%	54	0.51%	18	0.05%
Error 3 - noise	95	0.31%	207	1.97%	0	0.00%
Error 4 - incorrect # of feet	9774	31.63%	3327	31.69%	10471	28.93%
Error 5 - no weight distribution	887	2.87%	179	1.70%	4197	11.59%
TOTAL FRAMES	10802	34.96%	4471	42.58%	16765	46.31%

Table 2 Error classifications for 3 cases

Classifying Errors

- Manually observed algorithm output and compared with Excel data
- Identified lines with no data (i.e. where all fields = 0)
- Checked if Excel output matched expected output for each frame
- Identified 5 types of errors:
 - Right foot is identified by the algorithm as the left foot
 - Left foot is identified by the algorithm as the right foot
 - Noise produced by outside sources (i.e. other equipment)
 - Incorrect number of feet on the mat
 - 2 feet are identified as 1 foot
 - 1 foot fully off the mat for an extended number of frames
 - 1 foot on the mat, 1 foot only partially on the mat
 - More than 2 feet on the mat, but identified as only 2 feet
 - Foot objects and centers of pressure are identified, but not the subject's weight distribution

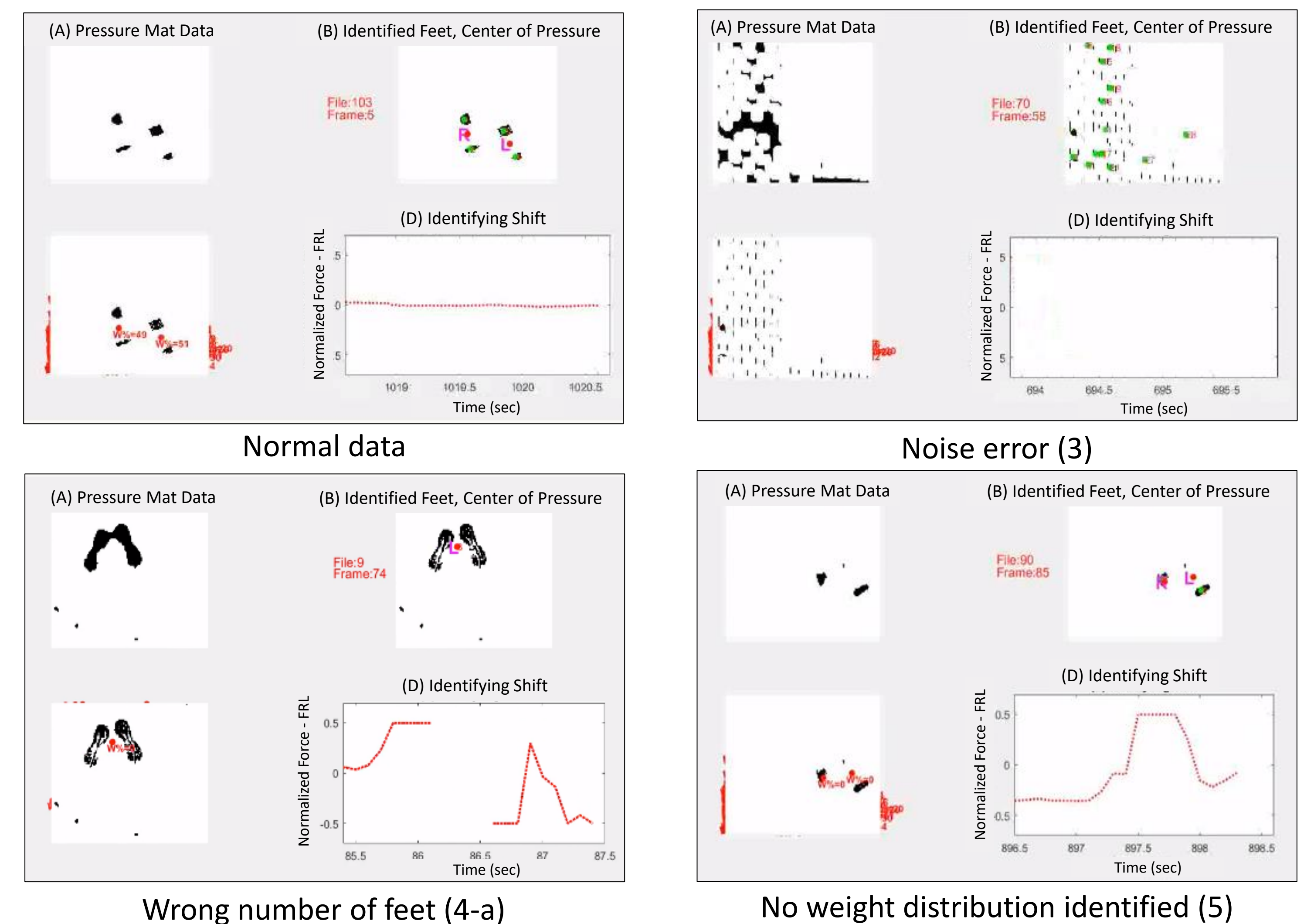


Fig. 3 MATLAB visual outputs of normal and erroneous data

Discussion

- On average, approximately 41% of frames contain errors in correctly identifying the right and left foot
- Most prevalent error is incorrect number of feet on the mat (error 4)
 - Accounts for ~ 30% of all frames
 - Accounts for ~ 75% of all errors
- Identification strategies vary by type of error:
 - Wrong foot errors (errors 1 and 2) can only be identified visually because data appears normal in Excel
 - Noise errors can often be detected through Excel data because they appear as spots of data amidst no data
 - Only one foot on the mat for an extended period can be easily identified by excel data
 - Remaining types of error 4 typically require visual detection

Acknowledgements

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References

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