

Understanding sow's mothering ability by analyzing their behavioral phenotypes from overhead sensor images

Ahla Al Kiyumi¹, Yeyin Shi¹, Tami Brown-Brandl¹, Isabella Condotta², Reginald Bolman³.

1-Biological Systems Engineering, University of Nebraska Lincoln, 2-Animal Science, University of Illinois, 3-Computer Science and Engineering, University of Nebraska Lincoln.



Introduction

- The United States is the world's third-largest pork-producing country and one of the largest pork exporters.
- 17.8% of the piglets born are lost before weaning (Stalder, 2018) and half of piglets are lost due to crushing by the sow (Lay et al., 2002; USDA, 2012).
- This Preweaning mortality (PWM) has detrimental effects on piglet well-being, worker morale, and economic returns to U.S. pork producers.
- Farrowing crates were provided by the swine industry to protect the piglets and provide space for them to move and limit the crushing by the sow. Unfortunately, with all these restrictions, the crushing still occurs.

Objectives

- Identify a series of sows' postures that are potentially related to their mothering ability from the overhead digital and depth images collected in a swine barn over the pre-weaning period.
- Analyze the time difference of each posture between the sow with high and low piglet mortality rates.

Results and Discussion

- More than 100,000 depth images were labeled for 5 Low piglet pre-weaning mortality sows and 5 high piglet pre-weaning mortality sows.
- In the first 24 hours, high mortality sows spent more time than low mortality sows on standing, sitting, and lying on belly; However low mortality spent more time on kneeling posture.
- Time budget analysis showed that the average time spent on kneeling posture is higher in all three days for low mortality compared to high mortality.
- The average time spent on sitting posture for high mortality is higher than low mortality in all three days.
- Unpaired t-test using 0.1 alpha showed that they are not significantly different in their behaviors within the first 24 hours.

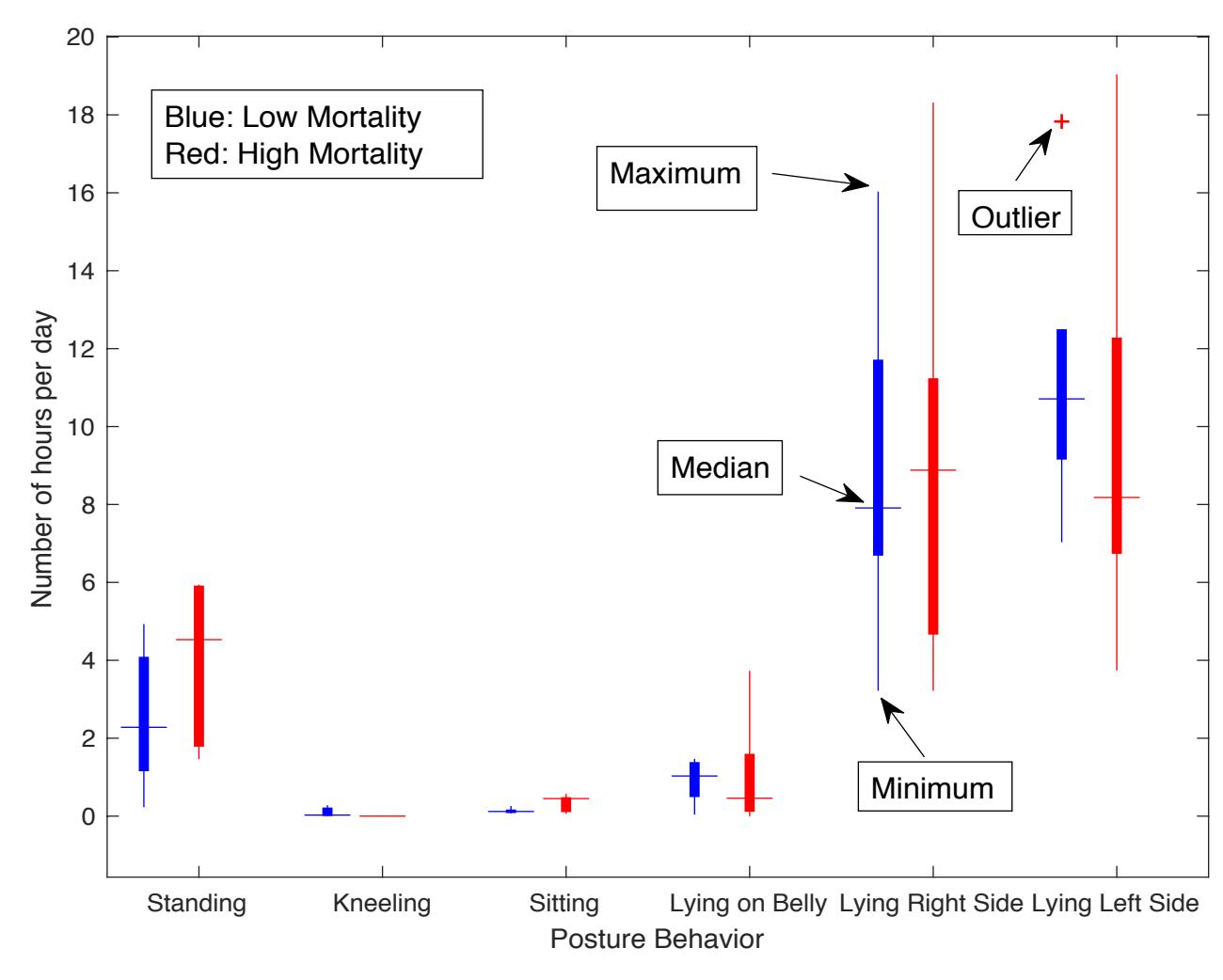


Figure2 . Time budget variation in each posture behavior between 5 low piglet pre-weaning mortality and 5 high piglet pre-weaning mortality sows in the first 24 hours after farrowing.

Methods

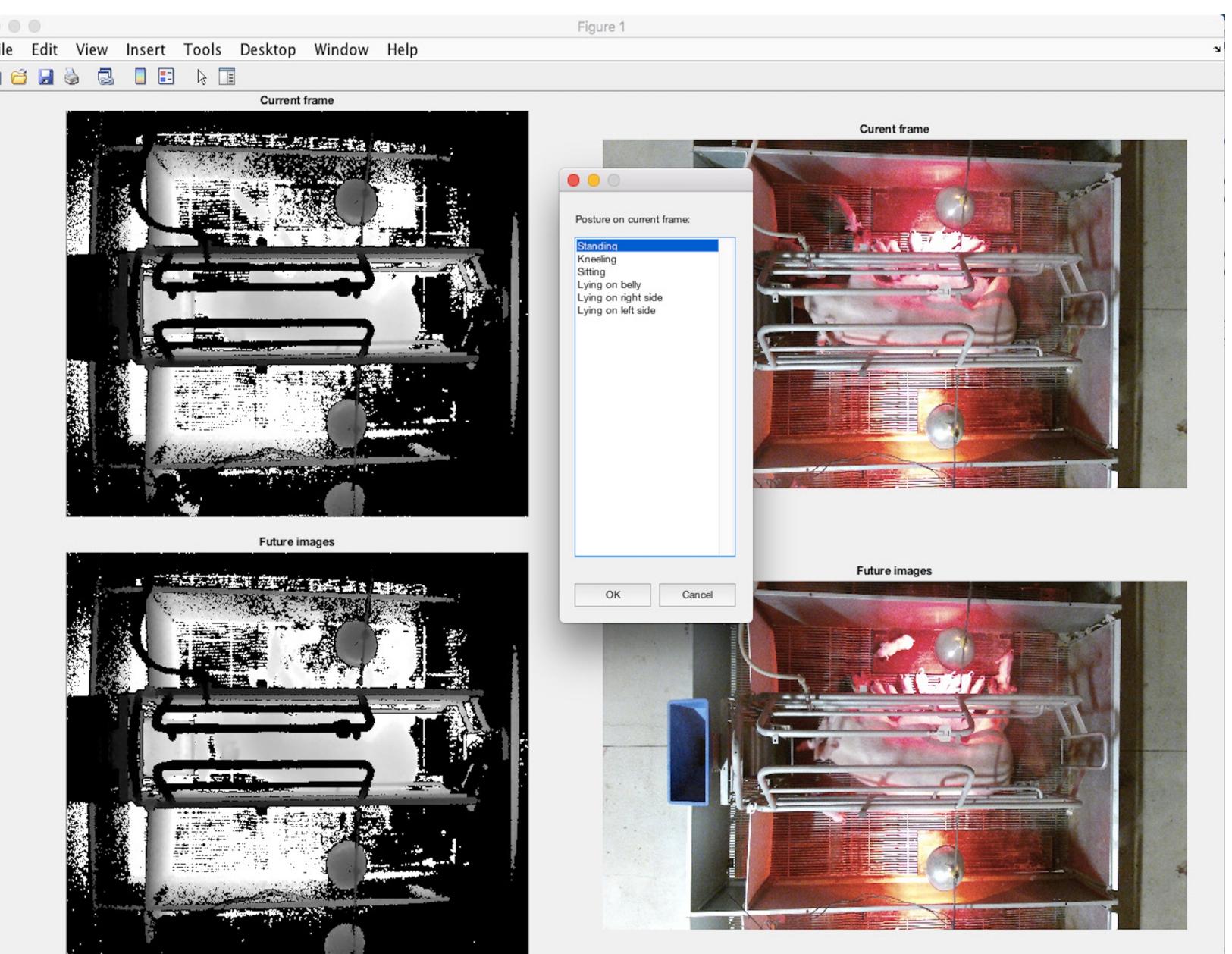
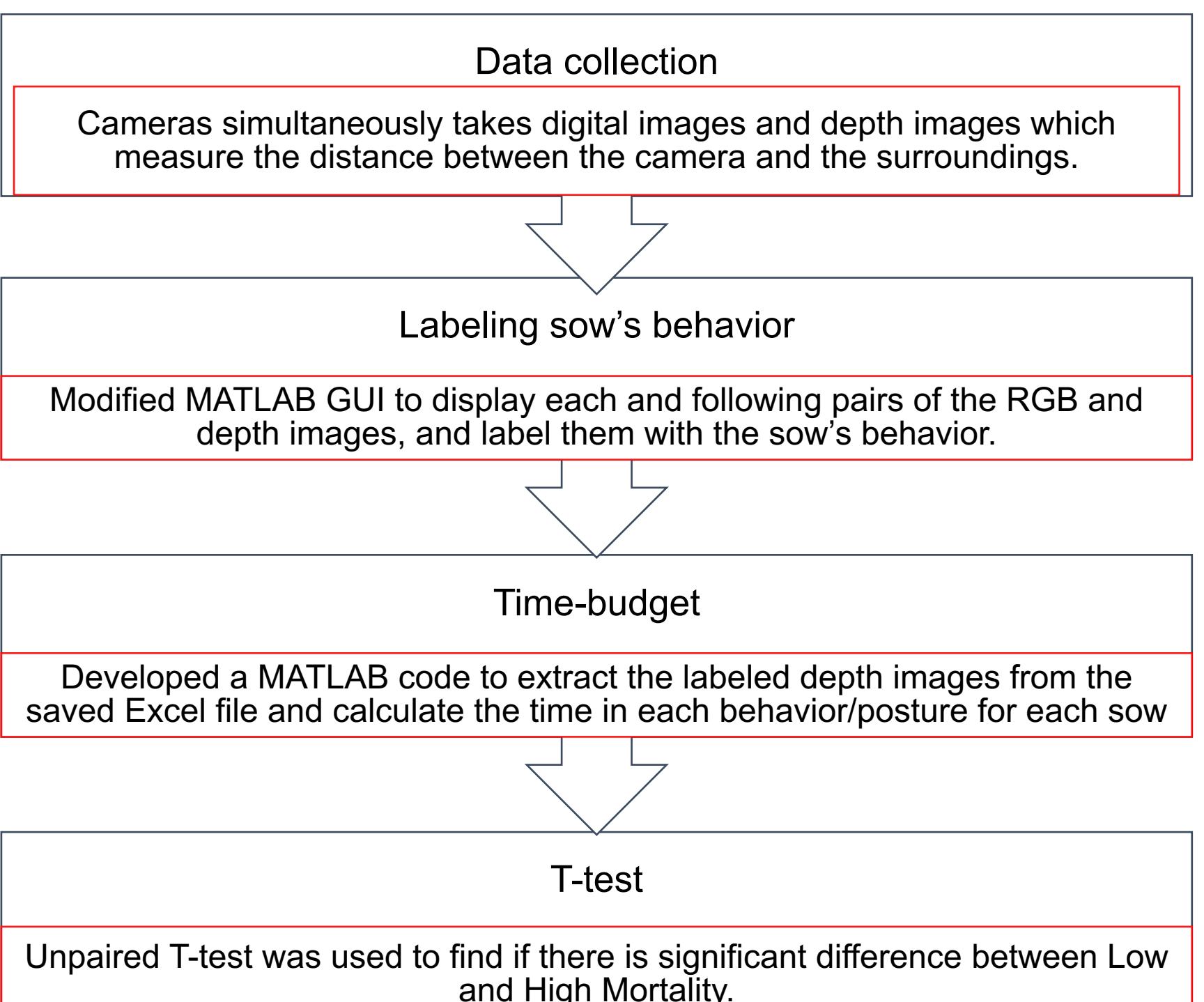


Figure1. Screenshot of the MATLAB after running the program. The top two images are the current frame, and the bottom two images are short running of the next five frames to help classify the image.

Conclusion and Future directions

Based on the 10 sows we analyzed, we concluded that there are some marked differences between low mortality and high mortality sows on kneeling, sitting , and standing behaviors.

We investigated the potential of using convolutional neural network based deep learning on automatically classifying sow's postures in the overhead images. The model showed 98.33% accuracy on labeling sow's behavior.

Adding a new posture behavior which is lying other into the six categories.

Add more sows to the research.

Publishing a journal article

References

- Lay, D., Matteri, R., Carroll, J., Fangman, T., & Safranski, T. (2002). Preweaning survival in swine. *Journal of Animal Science*, 80(E-suppl_1), E74–E86.
- Stalder, K. J. (2018). 2017 Pork Industry Productivity Analysis. Retrieved from <https://www.pork.org/wp-content/uploads/2018/09/2018-pork-industry-productivity-analysis.pdf>
- USDA, F. (2016). Livestock and Poultry: World Markets and Trade. United States Department of Agriculture. *Foreign Agriculture Service*.

Acknowledgements

- UCARE Program, Undergraduate research program, University of Nebraska Lincoln.
- Adil AL Siyabi, PhD student, University of Nebraska Lincoln.
- Veronica Madeira Pacheco, PhD student, University of Sao Paulo, Brazil.