Classifying individual northern Atlantic right whales

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Abstract: Accurate monitoring of individuals in a threatened species is of upmost importance to conservationists and researchers. Human observation is expensive and autonomous ariel photography is becoming an increasingly useful technique regarding animal biometrics [1, 2]. We employ a wide range of interesting techniques to build a ”face-identification” algorithm for ariel photos of northern Atlantic right whales. We follow a conventional modern face recognition pipeline consisting of the stages: detect, align, represent and classify [3]. We use deep learning algorithms to both detect and classify. A fully convolutional network [4] is employed to semantically segment a given image to infer the location of the whale's head and body, we then use PCA on the resulting image to normalize for the whale's direction. Hand labelling masks is needed to generate supervised training data.

1. Introduction

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1.1. Related work

Subsection text here.

1.1.1. Conclusion:

Subsubsection text here.

2. Whale normalization

2.0.2. Results:

3. Whale classification

3.0.3. Results:

4. Conclusion

Sample equations.

$$\begin{aligned}\frac{\partial u(t,x)}{\partial t} &= Au(t,x)\left(1-\frac{u(t,x)}{K}\right) - B\frac{u(t-\tau,x)w(t,x)}{1+Eu(t-\tau,x)},\\ \frac{\partial w(t,x)}{\partial t} &= \delta\frac{\partial^2 w(t,x)}{\partial x^2} - Cw(t,x) + D\frac{u(t-\tau,x)w(t,x)}{1+Eu(t-\tau,x)},\end{aligned} \tag{1}$$

$$\begin{aligned}\frac{dU}{dt} &= \alpha U(t)(\gamma - U(t)) - \frac{U(t-\tau)W(t)}{1+U(t-\tau)},\\ \frac{dW}{dt} &= -W(t) + \beta\frac{U(t-\tau)W(t)}{1+U(t-\tau)}.\end{aligned} \tag{2}$$

$$\left.\frac{\partial(F_1,F_2)}{\partial(c,\omega)}\right|_{(c_0,\omega_0)} = \left|\begin{matrix}\frac{\partial F_1}{\partial c} & \frac{\partial F_1}{\partial \omega}\\ \frac{\partial F_2}{\partial c} & \frac{\partial F_2}{\partial \omega}\end{matrix}\right|_{(c_0,\omega_0)} = -4c_0q\omega_0 - 4c_0\omega_0p^2 = -4c_0\omega_0(q+p^2) > 0.$$

5. Enunciations

Theorem 1. Assume that $\alpha > 0, \gamma > 1, \beta > \frac{\gamma+1}{\gamma-1}$. Then there exists a small $\tau_1 > 0$, such that for $\tau \in [0,\tau_1)$, if c crosses $c(\tau)$ from the direction of to a small amplitude periodic traveling wave solution of (2.1), and the period of $(\check{u}^p(s), \check{w}^p(s))$ is

$$\check{T}(c) = c \cdot \left[\frac{2\pi}{\omega(\tau)} + O(c - c(\tau))\right].$$

Condition 1. From (0.8) and (2.10), it holds $\frac{d\omega}{d\tau} < 0, \frac{dc}{d\tau} < 0$ for $\tau \in [0,\tau_1)$. This fact yields that the system (2.1) with delay $\tau > 0$ has the periodic traveling waves for smaller wave speed c than that the system (2.1) with $\tau = 0$ does. That is, the delay perturbation stimulates an early occurrence of the traveling waves.

6. Figures & Tables

The output for figure is:

Fig. 1. *Insert figure caption here*
a Insert Sub caption here
b Insert Sub caption here

The output for table is:

7. Conclusion

The conclusion text goes here.

Table 1 An Example of a Table

One	Two
Three	Four

8. Acknowledgment

Insert the Acknowledgment text here.

9. References

[1] L. Koh and S. Wich, "Dawn of drone ecology: low-cost autonomous aerial vehicles for conservation," 2012.

[2] J. Martin, H. H. Edwards, M. A. Burgess, H. F. Percival, D. E. Fagan, B. E. Gardner, J. G. Ortega-Ortiz, P. G. Ifju, B. S. Evers, and T. J. Rambo, "Estimating distribution of hidden objects with drones: From tennis balls to manatees," *PLoS One*, vol. 7, no. 6, p. e38882, 2012.

[3] Y. Taigman, M. Yang, M. Ranzato, and L. Wolf, "Deepface: Closing the gap to human-level performance in face verification," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2014, pp. 1701–1708.

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10. Appendices

Appendices are allowed but please be aware that these are included in the overall word count.