

Sesa Singha Roy¹, Reid Tingley², Dinh Phung¹, Alan Dorin¹

¹Faculty of IT, Monash University, Australia ²School of Biological Sciences, Monash University, Australia

Abstract

Understanding insect microhabitats in cities is important for understanding the nature of human-insect interactions. European honeybees provide important ecosystem services and aesthetic value to human gardens – we expect them to be found in natural microhabitats. European wasps, however, are often perceived as pests to humans and urban pets. We expect this species to be more common in artificial microhabitats than honeybees. Here, we study the presence of bees and wasps in urban¹ microhabitats to better understand and document human-insect interactions in our cities.

We use computer vision and machine learning tools to extract information on insect microhabitat from the backgrounds of online² images of European honeybees (*Apis mellifera*) and wasps (*Vespula germanica*), classifying them as either synthetic (e.g., brickwork, food packaging, textiles) or natural (e.g., leaves, grass, flowers.). We find evidence supporting the hypothesis that wasps are more likely than honeybees to be photographed in microhabitats with synthetic elements within built environments.



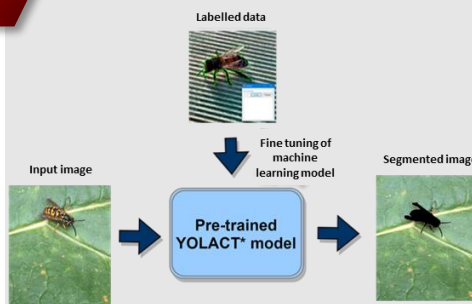
Methods

1. Data Collection

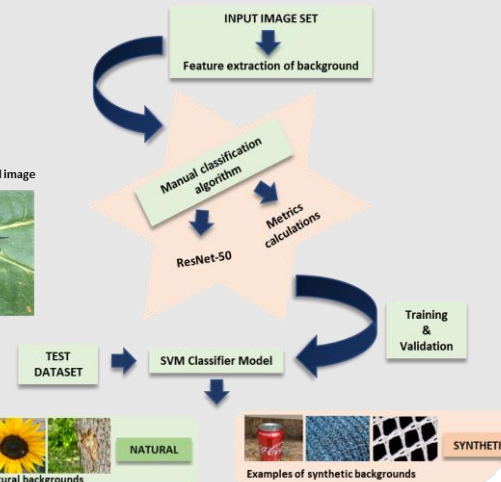
6000+ honeybee and 500+ wasp images were downloaded from the Atlas of Living Australia database.



2. Data preparation



3. Data processing



*You Only Look At CoefficientTs³

Futurework



We will use this novel technique to identify the microhabitats of other urban-dwelling insect species from online images.

The misclassification of flower parts as synthetic, or other background features like rock/soil conglomerates and bee honeycomb, will be addressed in future work through improved algorithm training.

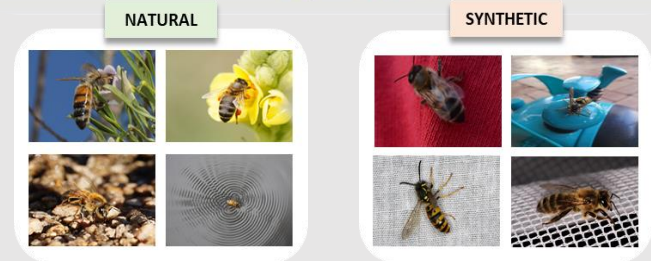
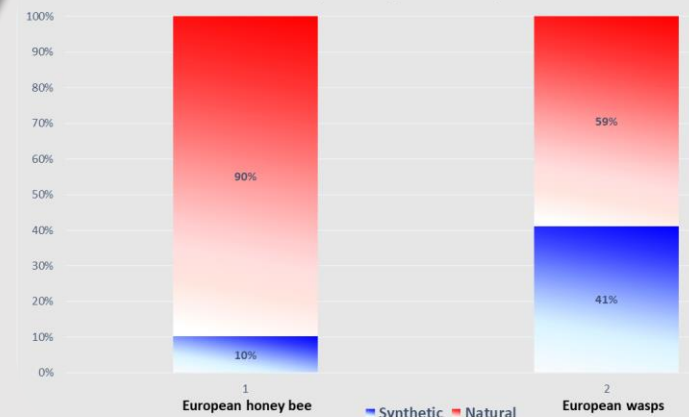
Results

Our results show **wasps** are seen both in **natural** and **synthetic** microhabitats. This finding accords with the species' ecology – it is an urban pest and has a broad diet including carrion, plants, fruits and packaged food.

Honeybees are found mostly in **natural** microhabitats. This result confirms our prediction, as flowers are their primary food source.

We anticipate using this technique to explore the microhabitats of lesser-known insects.

Natural vs Synthetic background classification for different species



References

- Corcos, D., Cerretti, P., Caruso, V., Mei, M., Falco, M., & Marini, L. (2019). Impact of urbanization on predator and parasitoid insects at multiple spatial scales. *PLoS one*, 14(4), e0214068
- Ghermandi, A., & Sinclair, M. (2019). Passive crowdsourcing of social media in environmental research: A systematic map. *Global environmental change*, 55, 36-47.
- Bolya, D., Zhou, C., Xiao, F., & Lee, Y. J. (2019). Yolact: Real-time instance segmentation. In *Proceedings of the IEEE/CVF International Conference on Computer Vision* (pp. 9157-9166).

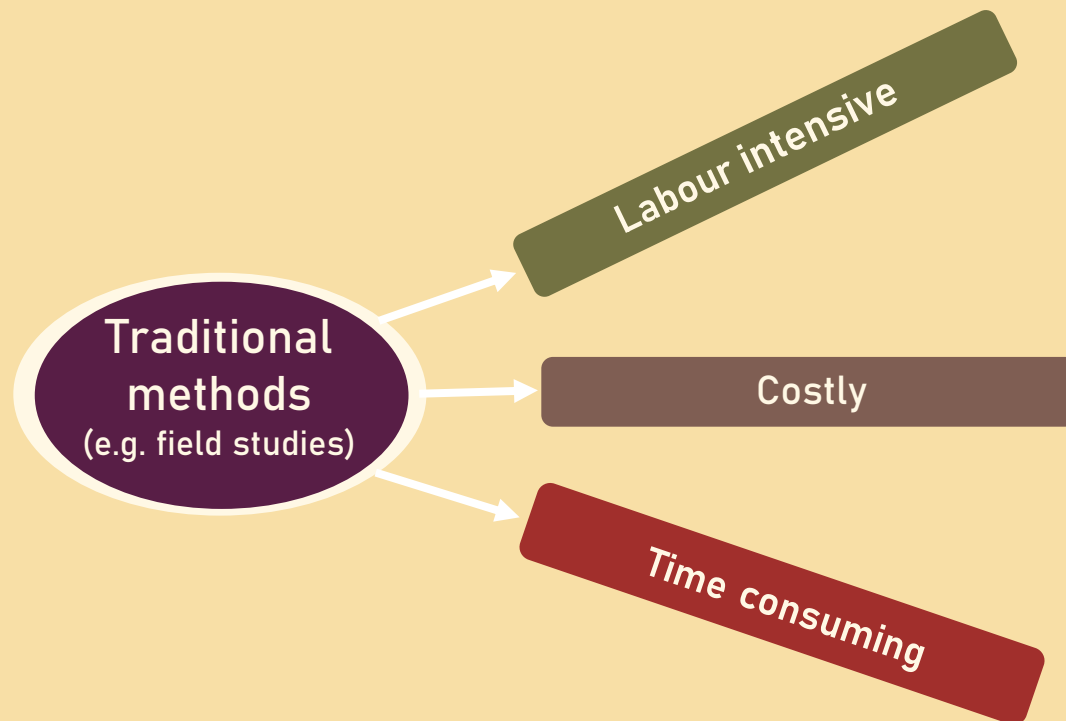
Background



European wasps as 'human pest'



Honey bee as 'pollinator'



Novel data-processing and 'machine learning techniques' to classify image backgrounds as natural or synthetic

Help to determine insect microhabitat

Will honey bees be encountered more often in natural backgrounds, and wasps frequently in synthetic backgrounds?

Our Approach...

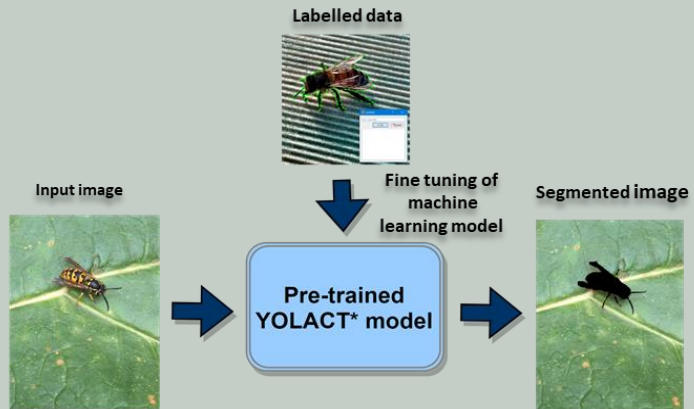


6000+ European honey bee & 500+ European wasps images

downloaded from Atlas of Living Australia (ALA)

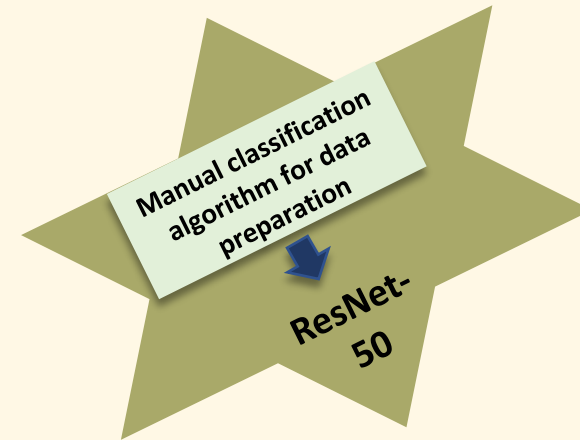


1

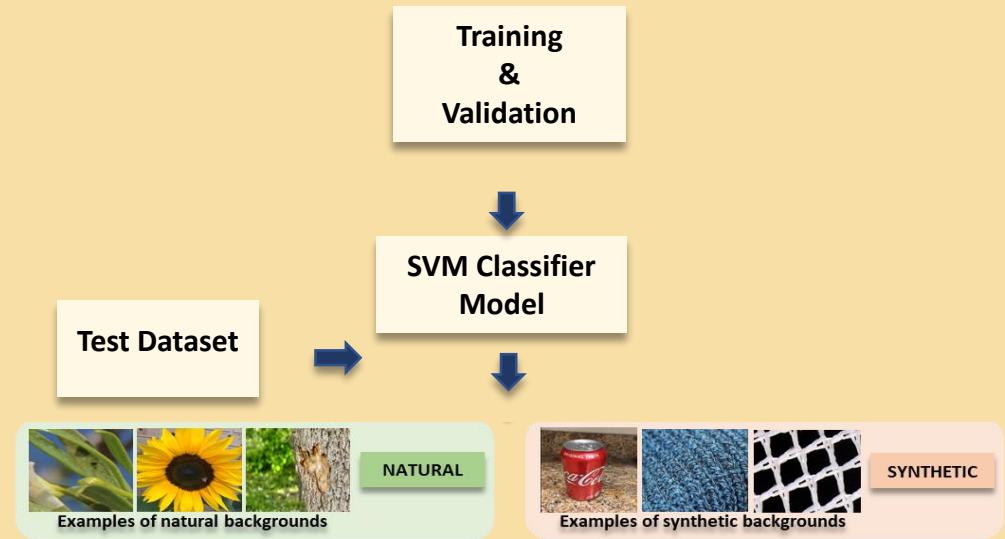


2

*You Only Look At CoefficientS



3



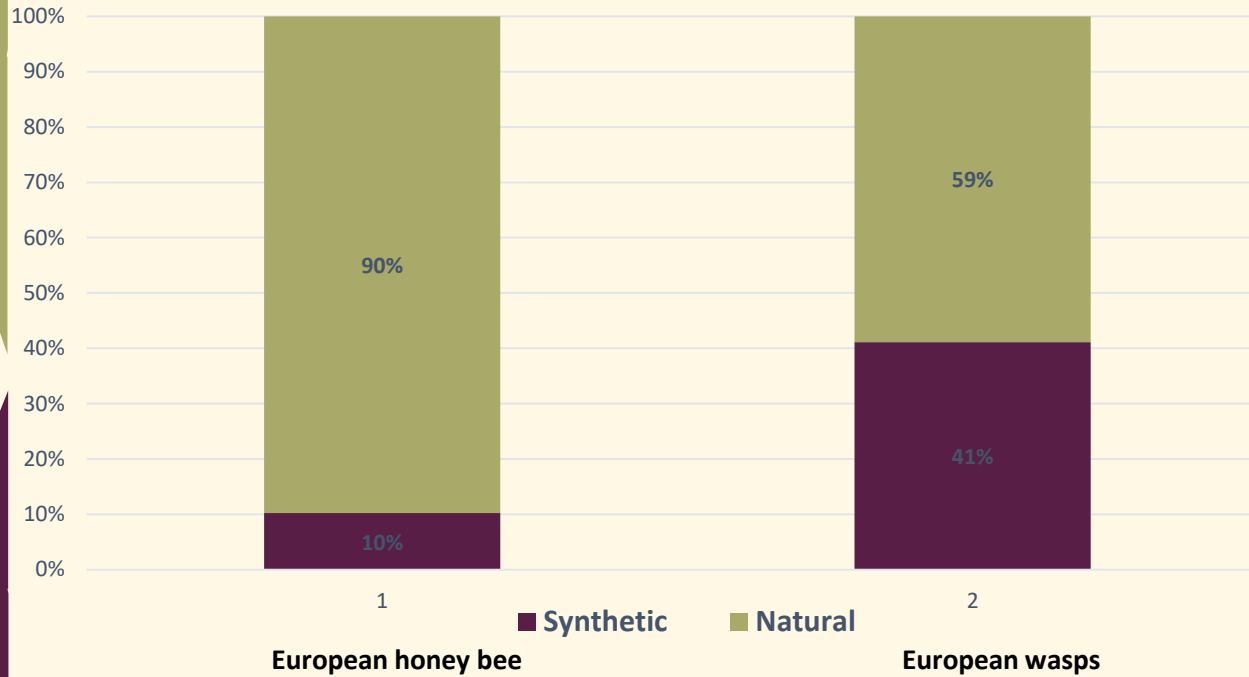
4

Our findings...

90%
natural



10%
synthetic

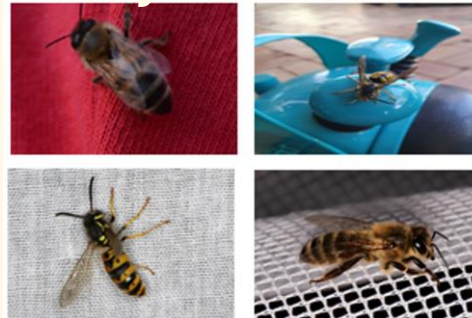


59%
natural

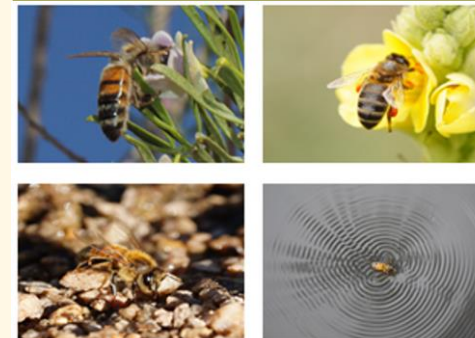


41%
synthetic

synthetic



natural



Sesa Singha Roy

sesa.singharoy@monash.edu

We anticipate using this technique to find out the microhabitat from insect images which are lesser known

