

# The development of an object-based classification model for monitoring sealed soil surfaces in urban environments

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## Background

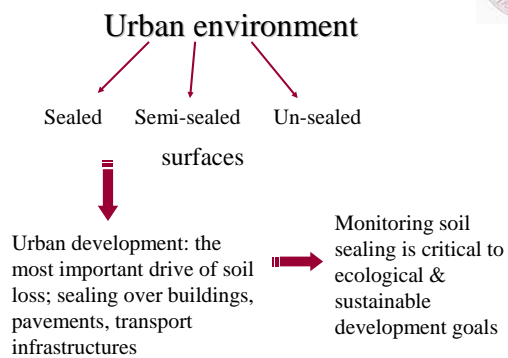
### Soil sealing

“Soil sealing refers to changing the nature of the soil such that it behaves as an impermeable medium and describes the covering or sealing of the soil surface by impervious materials by concrete, metal, glass, tarmac and plastic”

(EEA glossary, 2006)

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## Background



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## Aim & Objectives

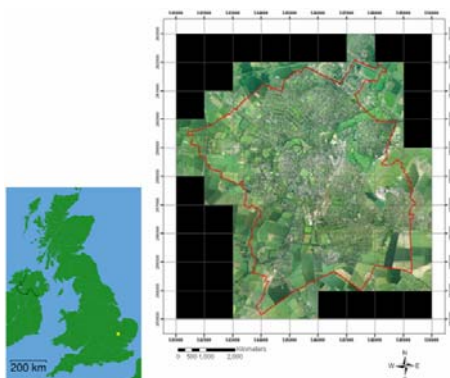
- To investigate whether OBIA could be a sufficient method for monitoring surface impermeability in UK urban environments at “garden level” scale

### Objectives:

- Develop a transferable object-based methodology to classify sealed soil and vegetated surfaces and test the transferability to different urban environments
- Compare OBIA with traditional Aerial Photo Interpretation (API) at different levels of thematic detail

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## Study area Cambridge, UK



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## Data availability



- Ortho-rectified aerial photography of Cambridge taken in July 2003
- 0.125 m spatial resolution
- 4 test sites, 250 \* 250 m

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Materials & Methods  
Sample areas

2 types of residential areas

1960's semi-detached houses

Victorian terrace houses



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Materials & Methods  
Sample areas

Industrial area

Commercial area



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Materials & Methods

Urban impervious land cover mapping

4 test sites – 4 different urban environments of Cambridge

Development of API

Development of an object-based model

Comparison

- Accuracy assesment (site 1)
- Correlation between accuracy & thematic scale (site 1)
- Transferability assesment

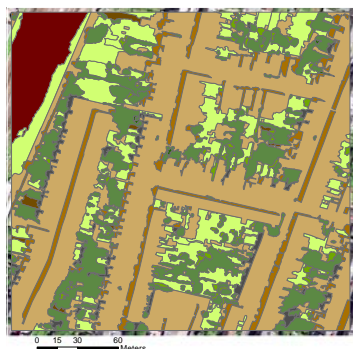
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Materials & Methods - API production  
On-screen digitising at 1:200 scale



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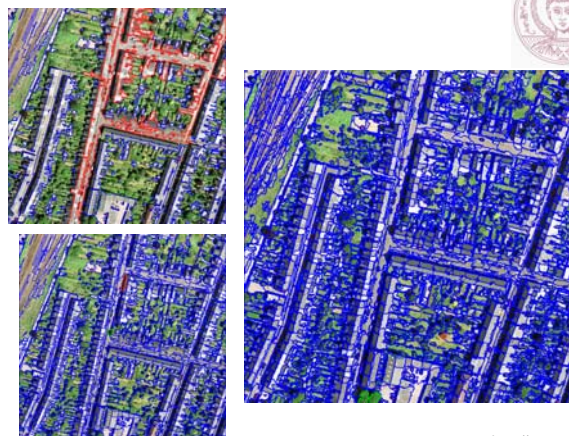
Materials & Methods - API production  
Manual classification



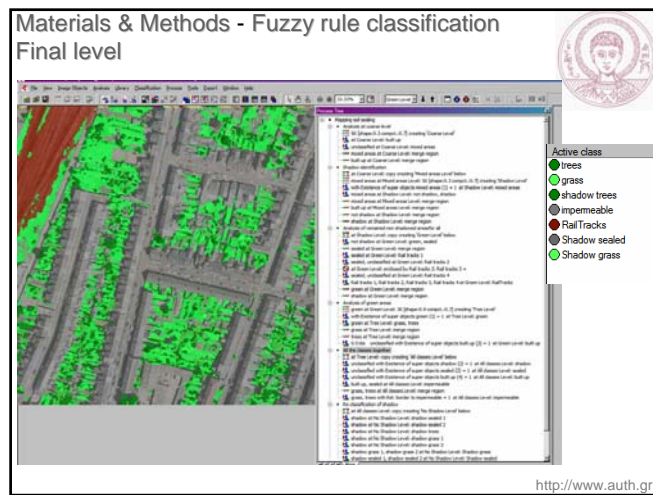
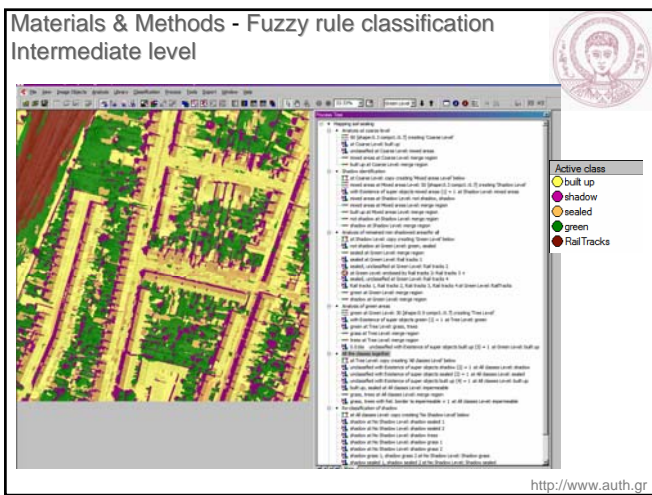
- Manual Classification**
- Victorian houses**  
description, description\_of\_shadow
- sealed/ impermeable surfaces
  - vegetation
  - trees
  - tree in shadow
  - mixed shadow (unclassified)
  - sealed surface in shadow
  - grass in shadow
  - rail tracks
  - bare soil
- Residential aerial**  
RGB
- Red: Band\_1
  - Green: Band\_2
  - Blue: Band\_3

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Materials & Methods-Multiresolution segmentation



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### Materials & Methods – OBIA model

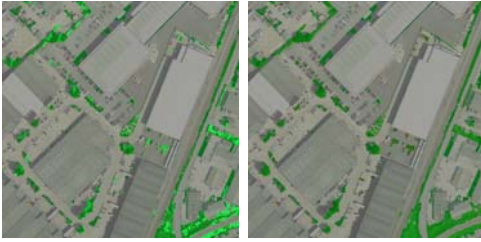
- Identical segmentation and classification parameters for all four test site representing different urban environments
- Assessment of transferability: no modification or calibration of the OBIA model

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## Results

Test site: Part of the industrial area



Classes: sealed, grass, trees, rails tracks: 87.6%  
Classes: sealed, green, rails tracks: 90%  
Classes: sealed, green: 95%

Z significant

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## Discussion

- The very high overall accuracy observed in all test sites indicates the transferability of the developed model in different urban environments
  - Calibrating the model before its application could result in higher accuracy
- Very high accuracy in identifying sealed soil surfaces in all test sites
- Main sources of confusion between:
  - trees and other types of vegetation (absence of vegetation height information)
  - rail tracks and sealed surfaces (development of fuzzy rule for rail track mapping at local level - site 1)

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## Conclusions - Recommendations

- Automated object based classification of the aerial photography proved to be an accurate method to map sealed and green areas at garden level scale
- The model proved transferable when applied to four different urban types
- The overall accuracy is affected by the level of thematic detail:
  - The average of 84% increased to 92% when a simply binary map of sealed-unsealed surfaces was produced
- The use of elevation information (i.e. LIDAR data) is necessary to discriminate low from high vegetation
- Application of the OBIA model to other UK cities in order to further test its transferability

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## Acknowledgements

The work was carried out at Cranfield University, UK as a part of my PhD research study. I would like to thank Gavin A. Wood and Tim R. Brewer for their contribution.

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Thank you!!

Questions?

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