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# ADELE: Overview of a deep learning application of land use and land cover change detection and classification in Switzerland

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GeoVision2



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## ADELE, a joint work with:

- Michael Leuenberger *Institute of Statistics, University of Neuchâtel; Statistical Methods Units, Swiss Federal Statistical Office*
- Gillian Milani *Exolabs GmbH, Zurich; Geoinformation Unit, Swiss Federal Statistical Office*
- Claudio Facchinetti *Geoinformation Unit, Swiss Federal Statistical Office*
- Fachhochschule Nordwestschweiz (FHNW)



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ExoLabs

Université  
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unine

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## ADELE : Arealstatistik Deep Learning

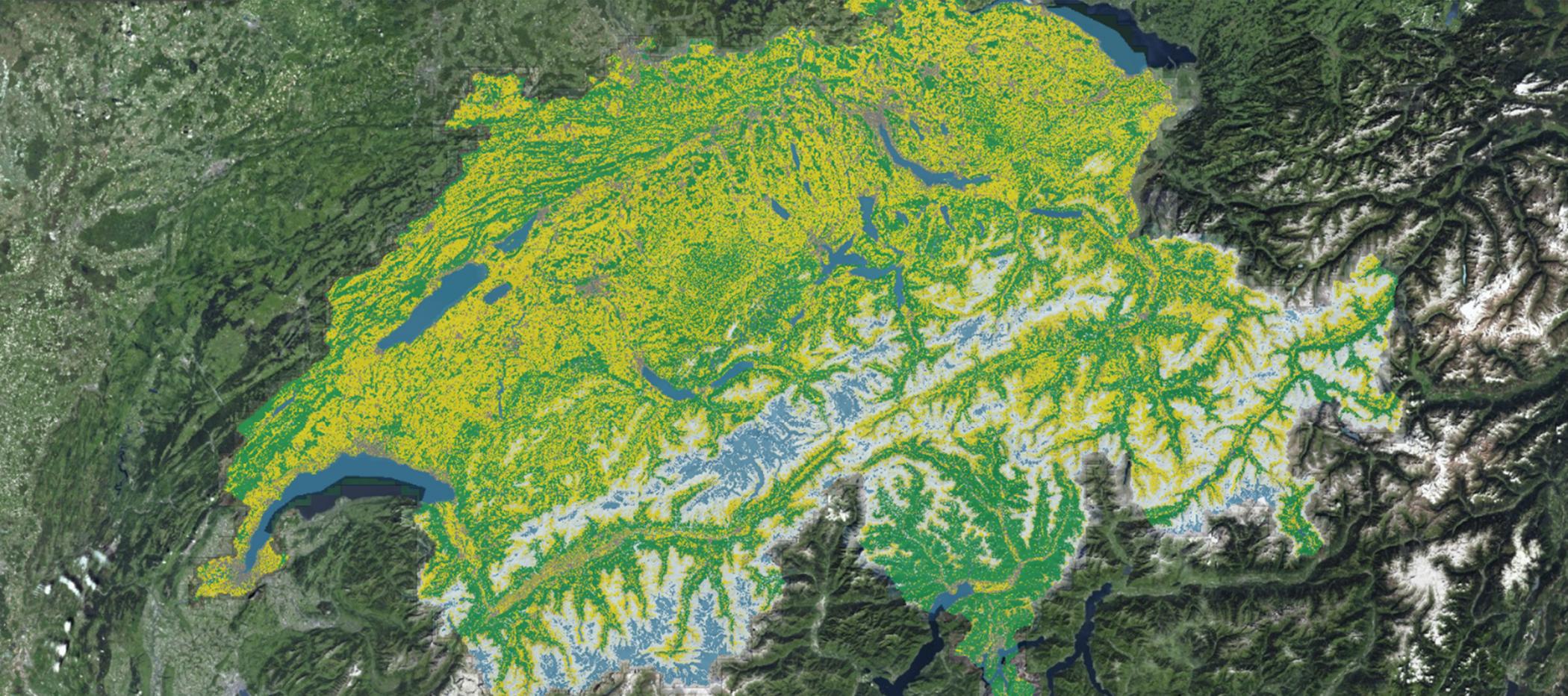


- Classification of land use and land cover at 100 meters resolution on a regular grid.
- More than 4 million of points to cover Switzerland.
- Interpretation based on aerial images.
- A total of 73 classes, 27 for land cover, and 46 for land use.



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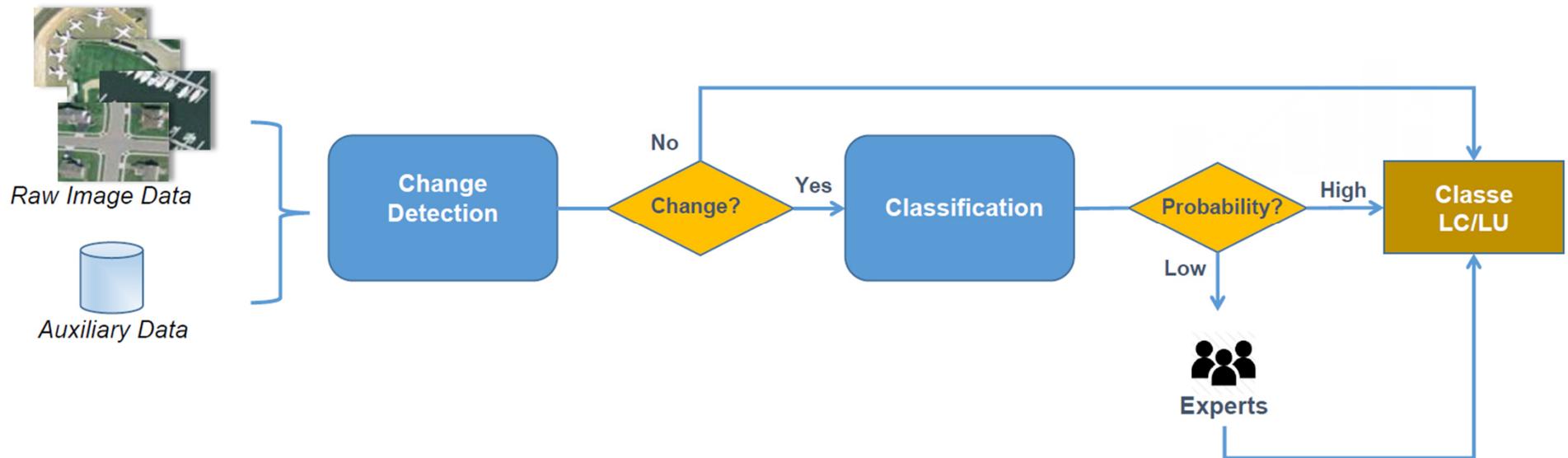
## Primary data and preprocessing



- Each data point is represented by an image of 200 x 200 pixels (50m x 50m)
- 3 channels available (RGB)
- 2 periods available with ground truth classification:
  - Area 3 (2004-2009)
  - Area 4 (2013-2018)

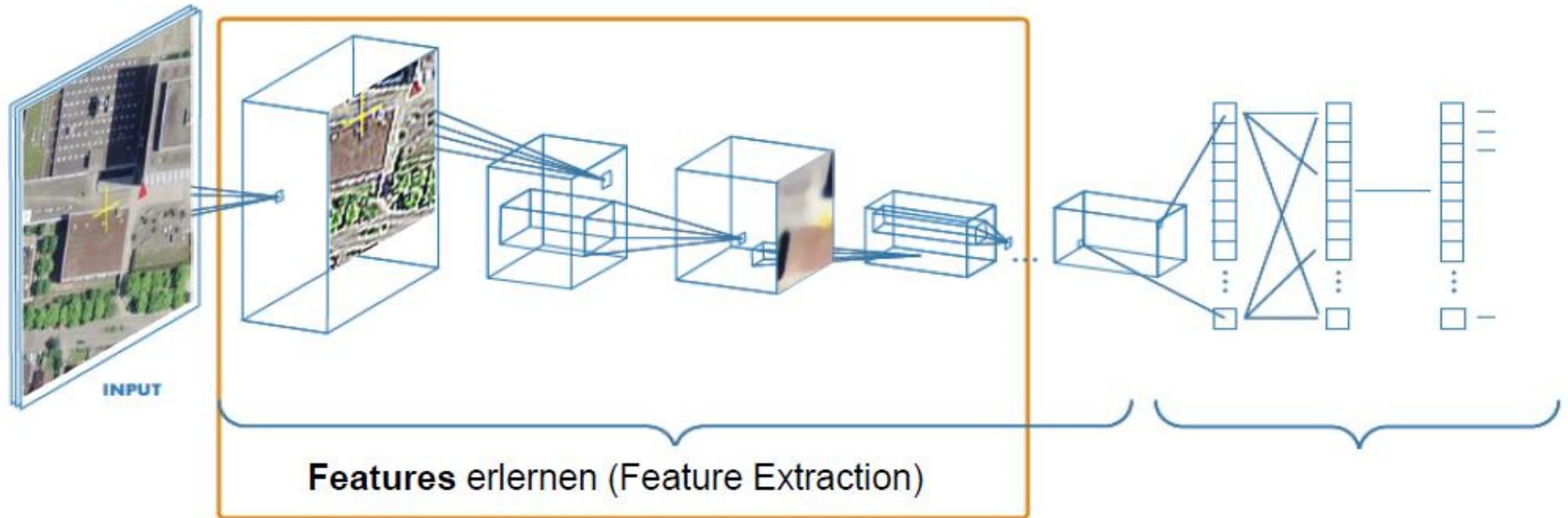


# Methodology



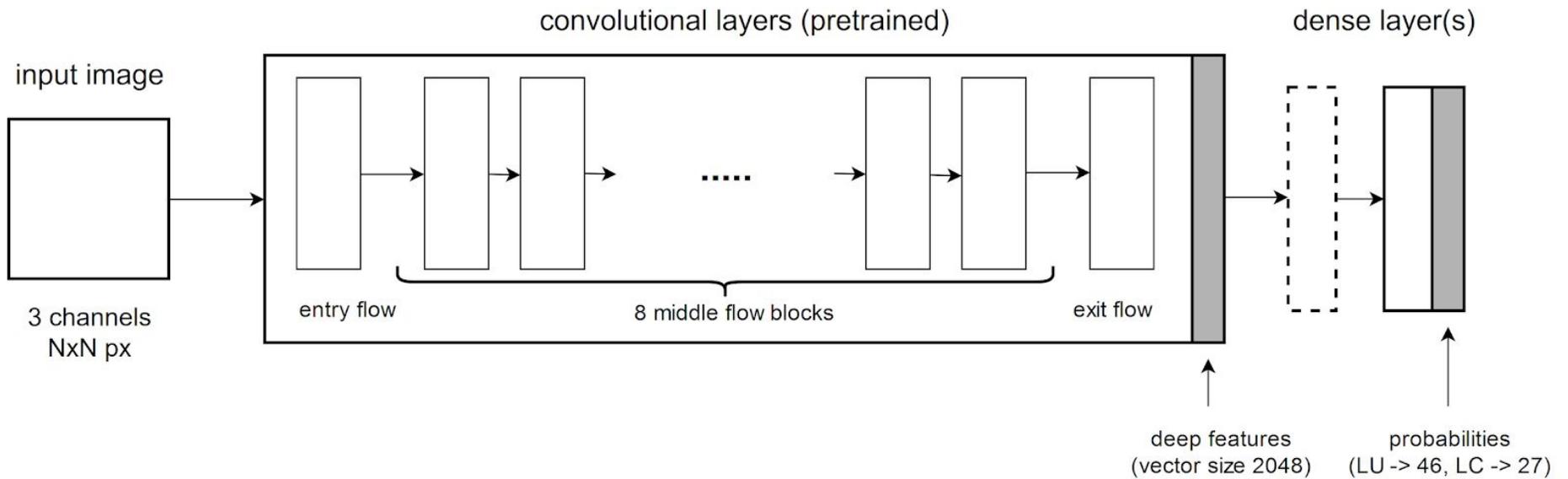


# Classification: Model structure CNN



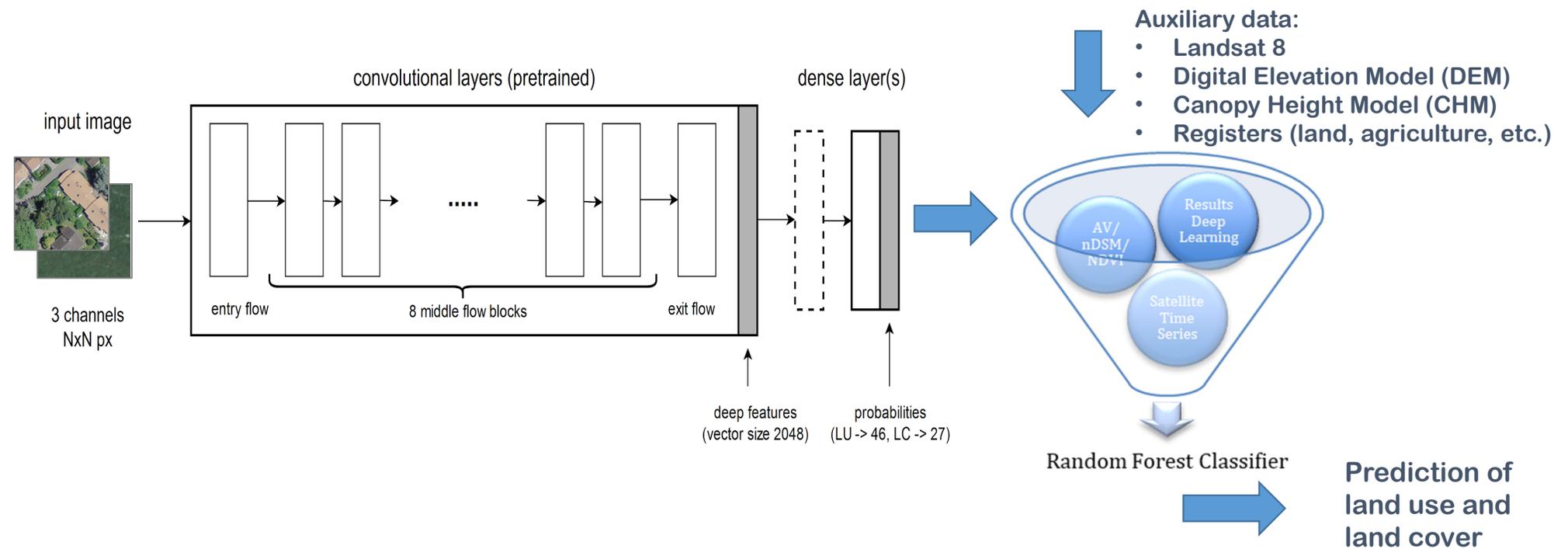


# Classification: Model structure CNN Xception



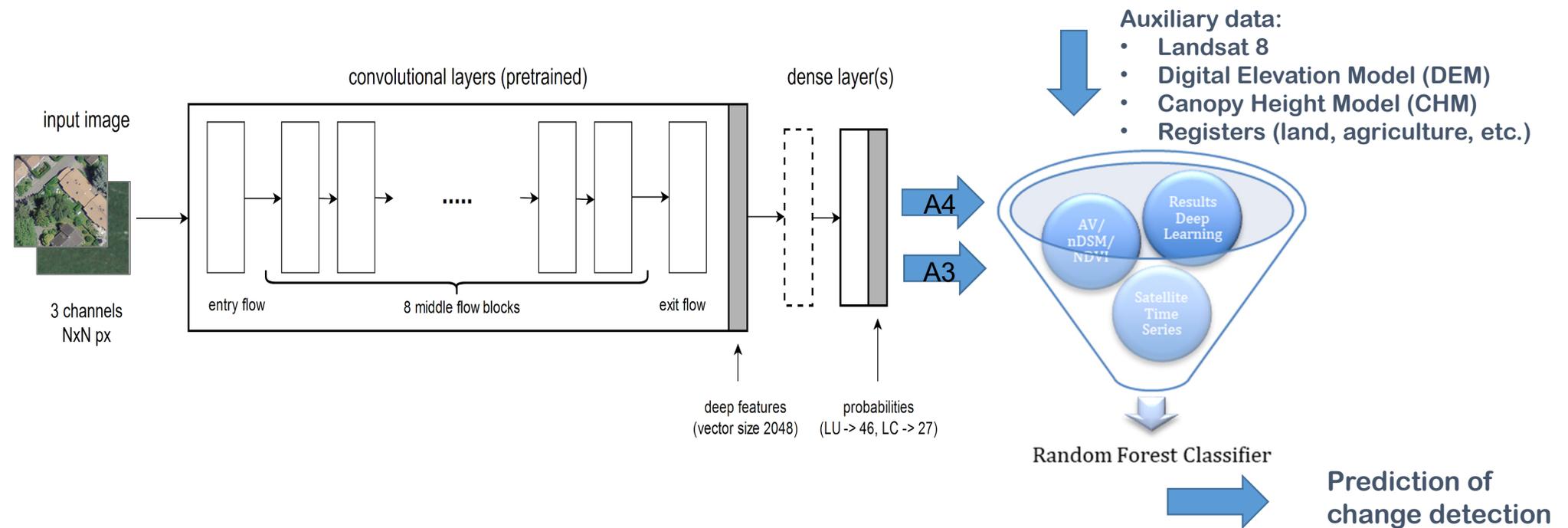


# Classification: Model structure CNN + RF





# Change detection





## Preliminary results for LU/LC classification

LC classes with high level of accuracy:

- Herbaceous vegetation
- Bodies of water
- Trees
- Glaciers

LU classes with high level of accuracy:

- Viticulture
- Arable land
- Mountain pastures
- Forests



- Wooded areas
- Agriculture
- Housing and infrastr.
- Improductive areas

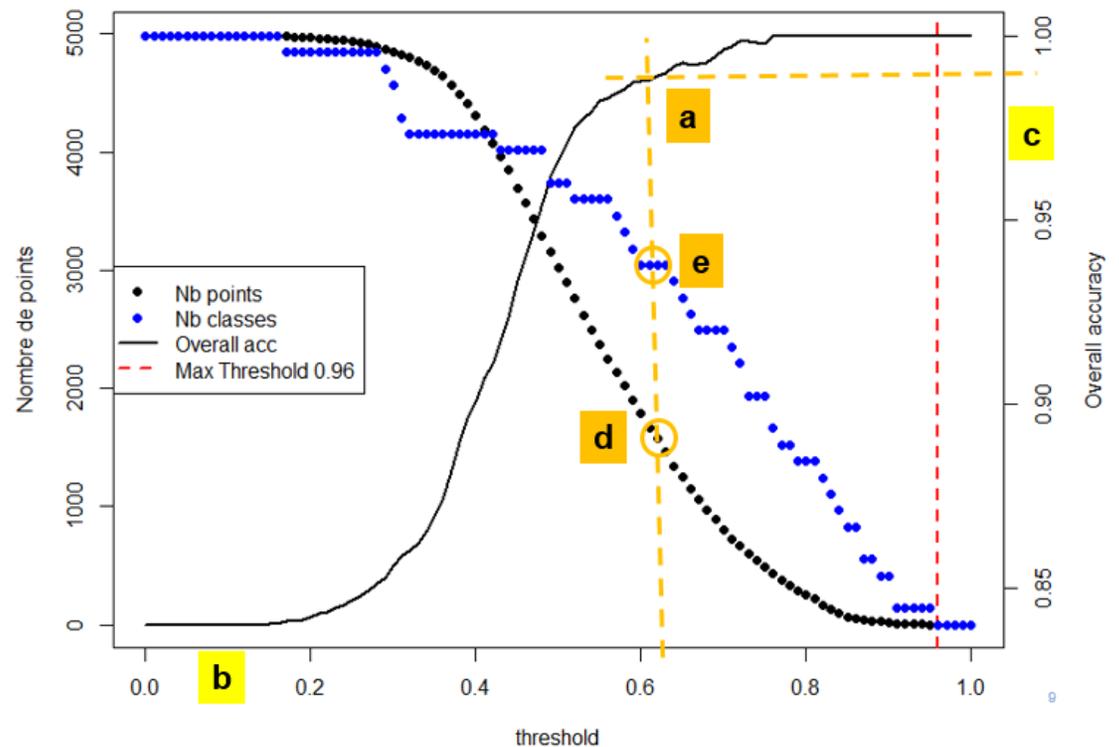


## Validation of predictions accuracies

### Example on a small trial dataset:

- Fix the desire level of accuracy you want to reach ( **c**:  $\geq 97\%$ ).
- From the validation dataset (**a**), it can be reached if the prediction probability threshold is set to 0.65 (axis **b**).
- **d** indicate that over 1'500 points out of 5'000 would not require a visual interpretation.

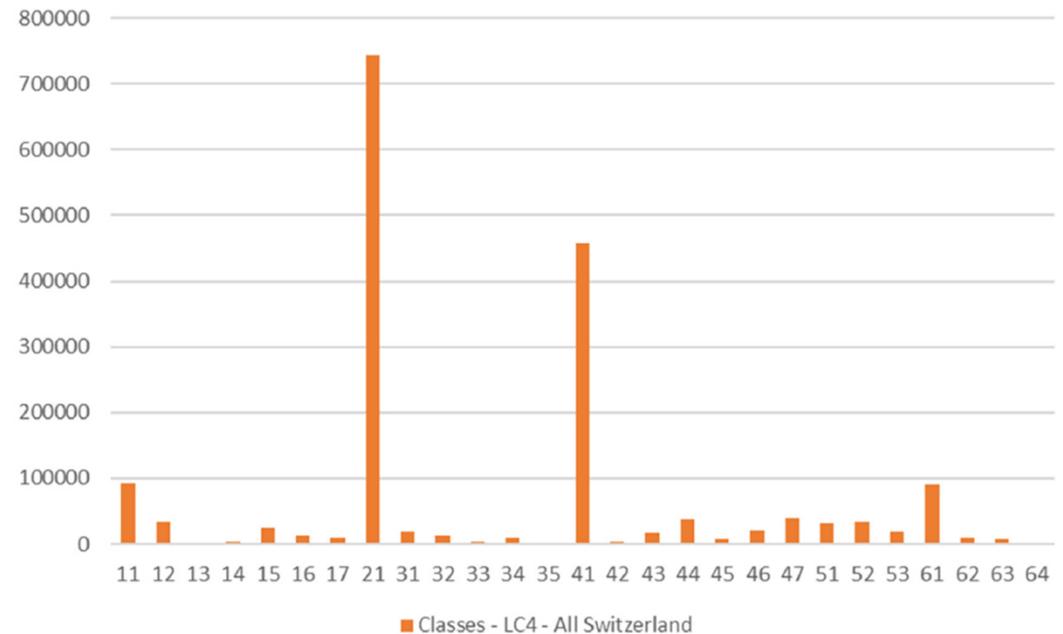
*Basis for integration in the visual interpretation process*





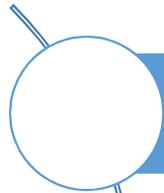
## Improvement and further steps

- High heterogeneity of classes distribution for both LU and LC.
- Computation of the prediction probability threshold for each LU and LC classes.
- New images (**AREA 5**) and new training set (this year).
- Additional auxiliary variables.

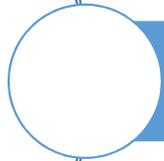




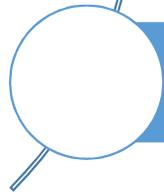
## Key takeaways



The use of deep learning algorithms provides means to potentially reduce the amount of work needed for the production of land use and land cover maps.



It allows a high level of accuracy by controlling the level of probability of each prediction point.



Further developments, in particular on additional auxiliary variables and optimizations of hyperparameters and thresholds, can significantly help to improve our preliminary results.



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## Thank you for your attention



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