



Meteorologisk  
institutt

# Downscaling Daily Temperature with Evolutionary Artificial Neural Networks

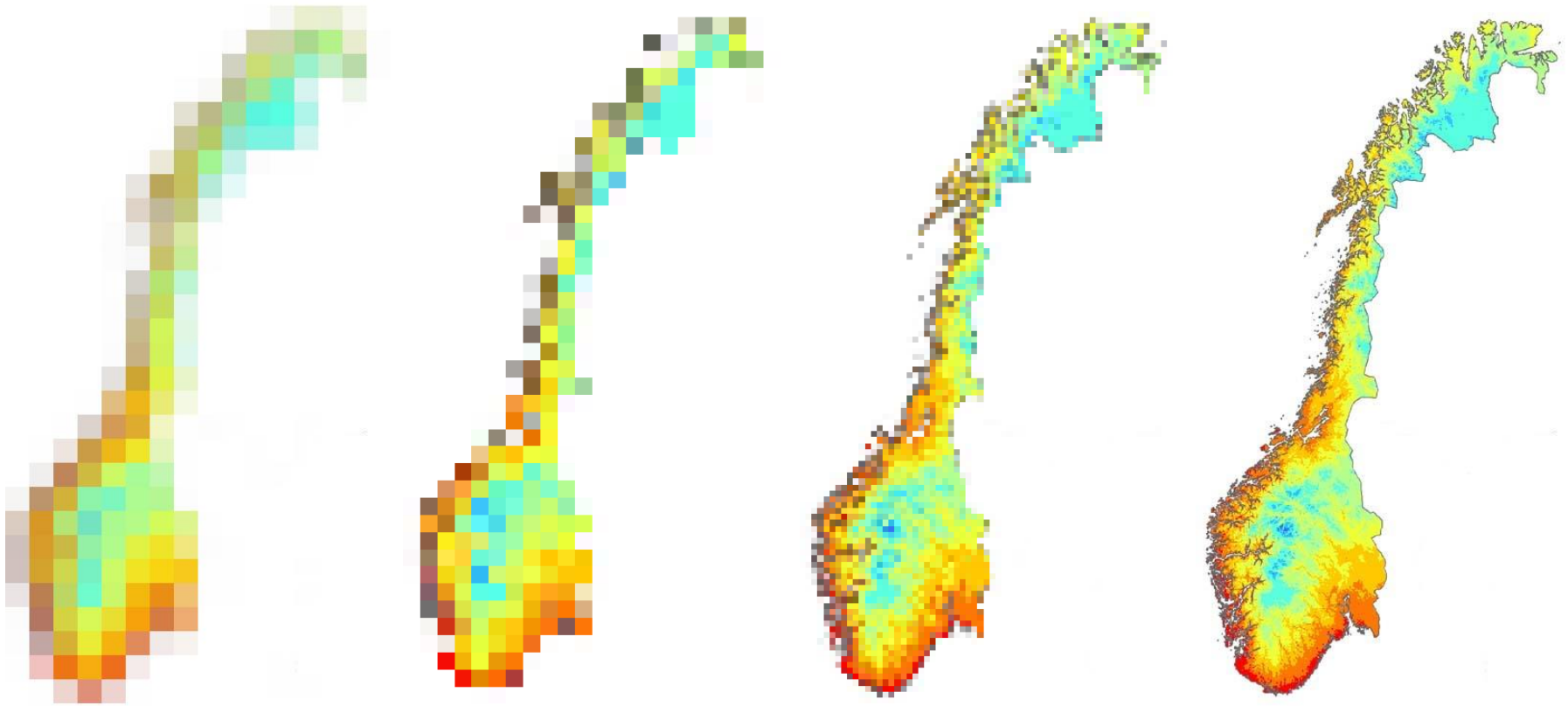
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Min Shi

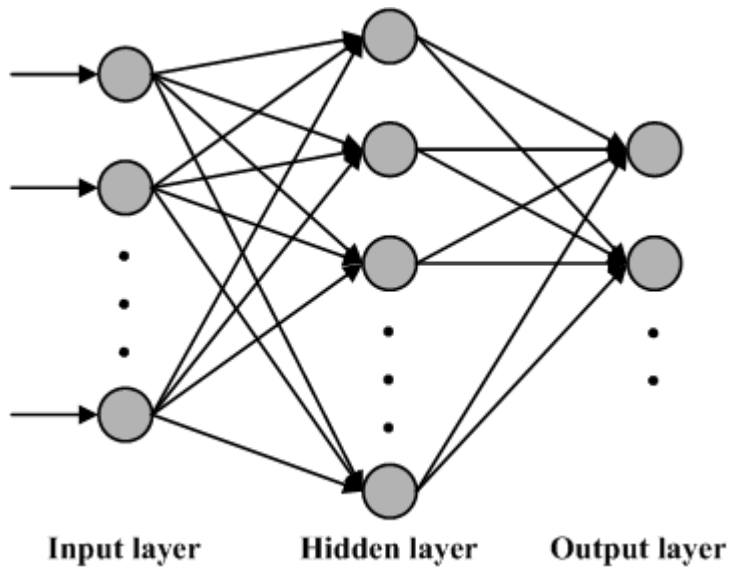
11.09.2015

# Downscaling

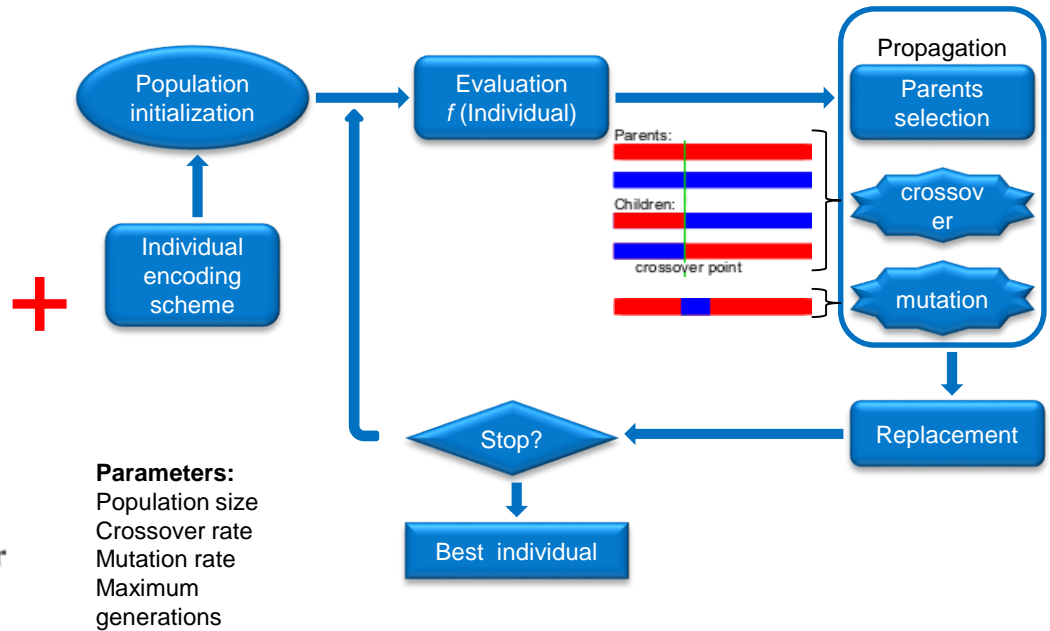
- Dynamic downscaling
- Statistical downscaling



# Neural Evolutionary Algorithms

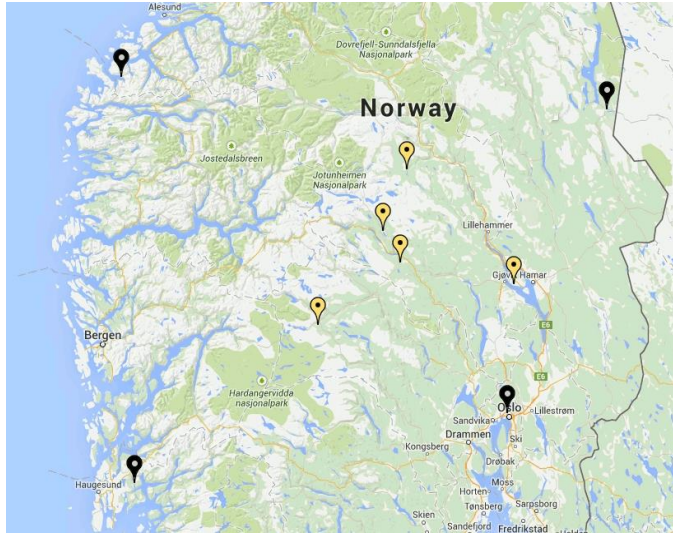


Artificial neural network



Evolutionary algorithm

# Experiments



STATION	Name	Location
Known station1	Fiskåbygd	62.10N, 5.58E
Known station2	Nedre Vats	59.48N, 5.75E
Known station3	Drevsjø	61.89N, 12.05E
Known station4	Oslo Blindern	59.94N, 10.72E
Unknown station1	Åbjørsbråten	60.92N, 9.29E
Unknown station2	Løken I Volbu	61.12N, 9.06E
Unknown station3	Kise Pa Hedmark	60.78N, 10.81E
Unknown station4	Geilostølen	60.52N, 8.2E
Unknown station5	Skåbu storslålen	61.52N, 9.38E

## Network Inputs:

INPUS	Input
1	Maximum temperature at known station 1
2	Maximum temperature at known station 2
3	Maximum temperature at known station 3
4	Maximum temperature at known station 4
5	Distance between station 1 and unknown station
6	Distance between station 2 and unknown station
7	Distance between station 3 and unknown station
8	Distance between station 4 and unknown station
9	Elevation of unknown station

## Network Output:

Maximum temperature of unknown stations

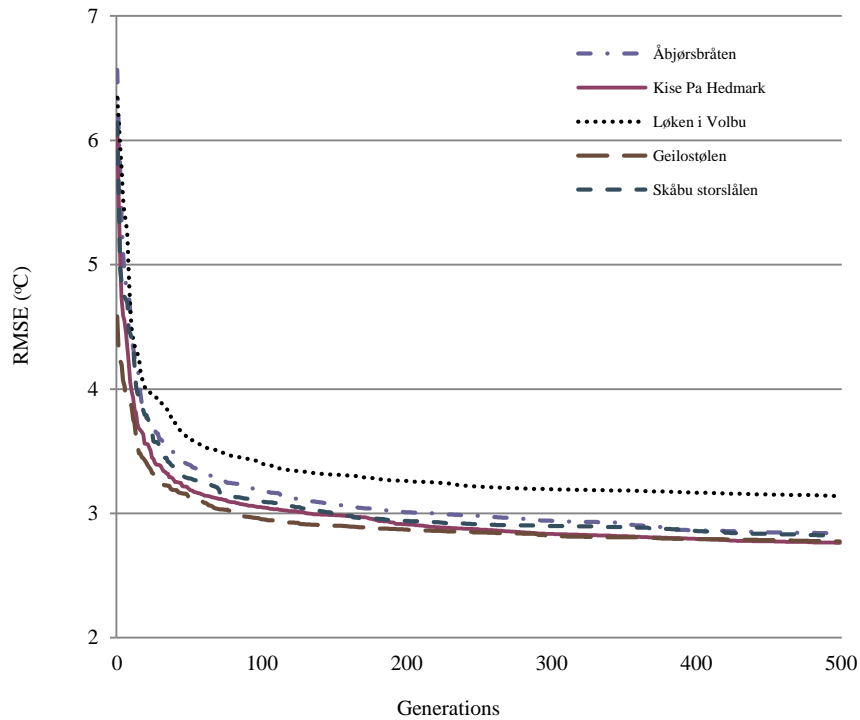
## Fitness function:

RMSE

## Training data:

Maximum daily temperature 1970-2010

# Results



Average training results

STATION	RMSE	R <sup>2</sup>
Åbjørsbråten	2.91	0.898
Løken i Volbu	3.19	0.893
Kise Pa Hedmark	2.85	0.912
Geilostølen	2.78	0.797
Skåbu storslålen	2.79	0.911

Average test results

# Conclusion and future work

- EANN shows good potential for the construction of high-resolution scenarios.
- Future works:
  - 1) Using reanalysis data set in experiments
  - 2) Compare the model with other method
  - 3) Improve model by using multi-objective evolutionary algorithms.

# ANN and EA applications

**Function Optimization:** 1) find the maximum or minimum output and the corresponding inputs for a given function 2) Tuning parameters

**Regression Analysis:** evolve a function or a model that matches the given input vectors and the corresponding outputs

**Combination Optimization:** Job-shop scheduling, circuit design, route optimization.

**Machine Learning:** classification, prediction, making decision, robotics.