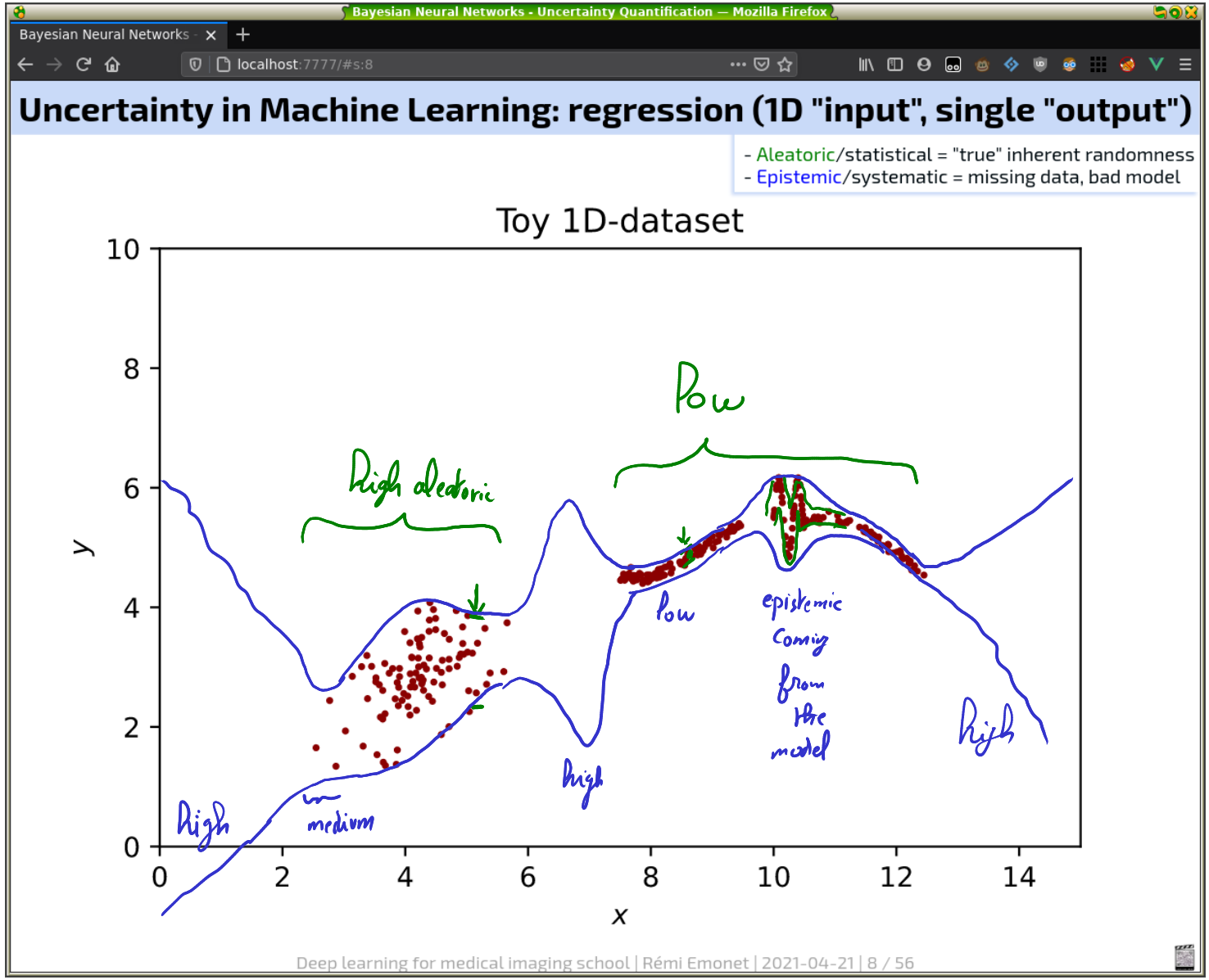
Bayesian Neural Networks, Uncertainty Quantification

School on Deep Learning for Medical Imaging

2021-04-21
Rémi Emonet
(remote event)


Bayesian Neural Networks - Uncertainty Quantification — Mozilla Firefox
Bayesian Neural Networks
localhost:7777/#s:8
Uncertainty in Machine Learning: regression (1D "input", single "output")
- Aleatoric/statistical = "true" inherent randomness
- Epistemic/systematic = missing data, bad model
Toy 1D-dataset
y
x
High aleatoric
Low
Low
epistemic
Coming
from
the
model
High
High
High
medium
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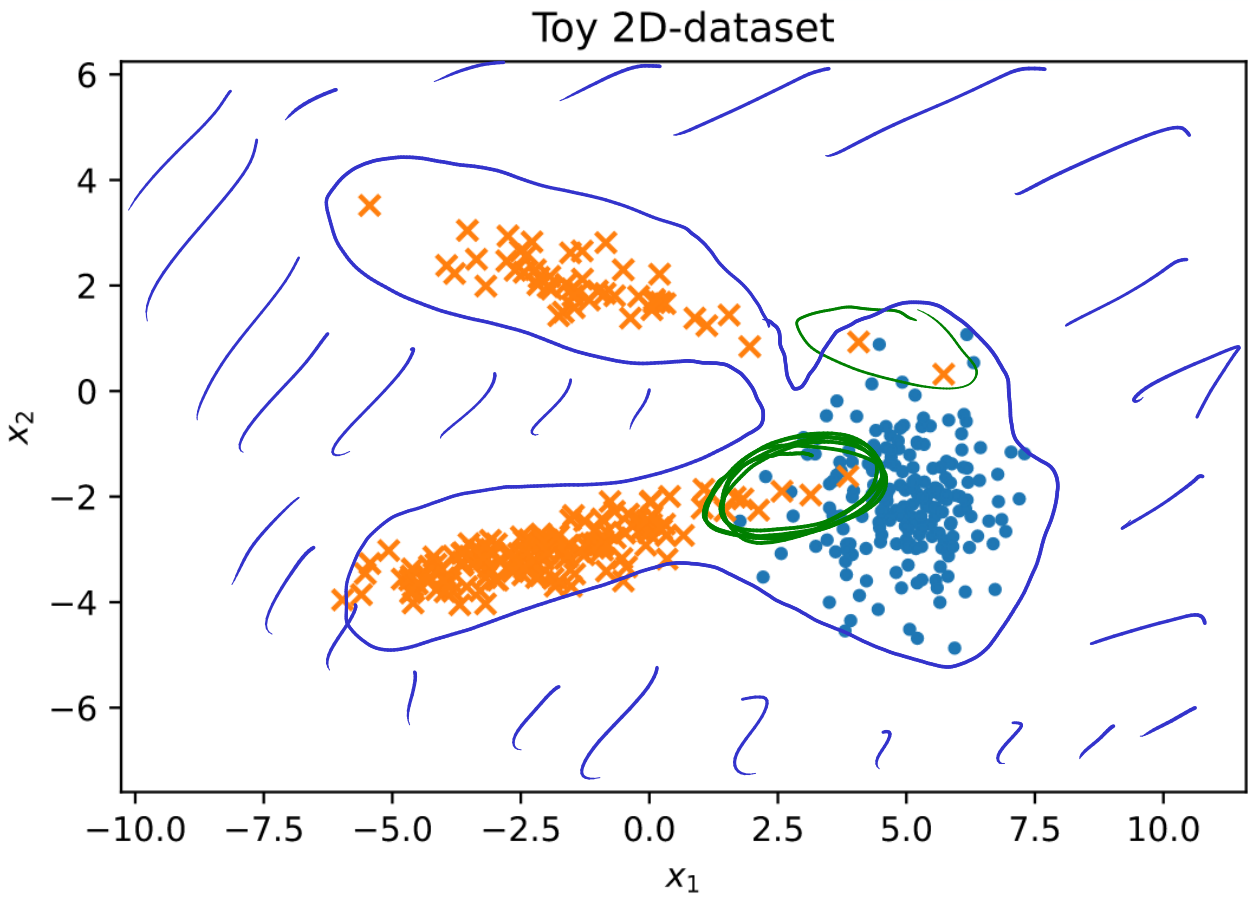
Bayesian Neural Networks - Uncertainty Quantification — Mozilla Firefox

Bayesian Neural Networks

localhost:7777/#s:9

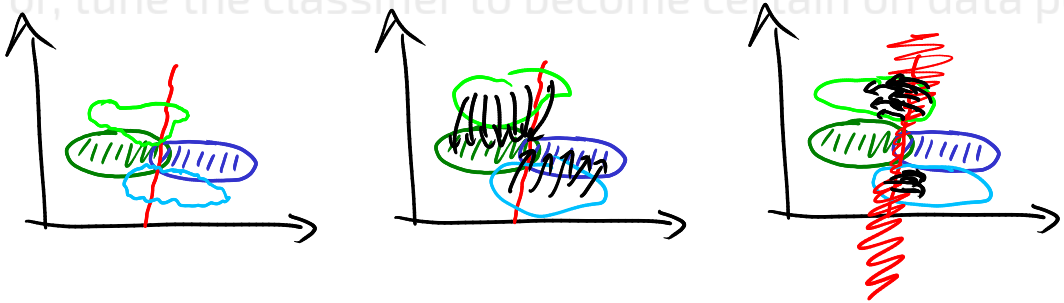
Uncertainty in Machine Learning: classification (2D "input", binary)

- Aleatoric/statistical = "true" inherent randomness
- Epistemic/systematic = missing data, bad model



Dataset Shift, Domain Adaptation, Transfer Learning (not today's focus)

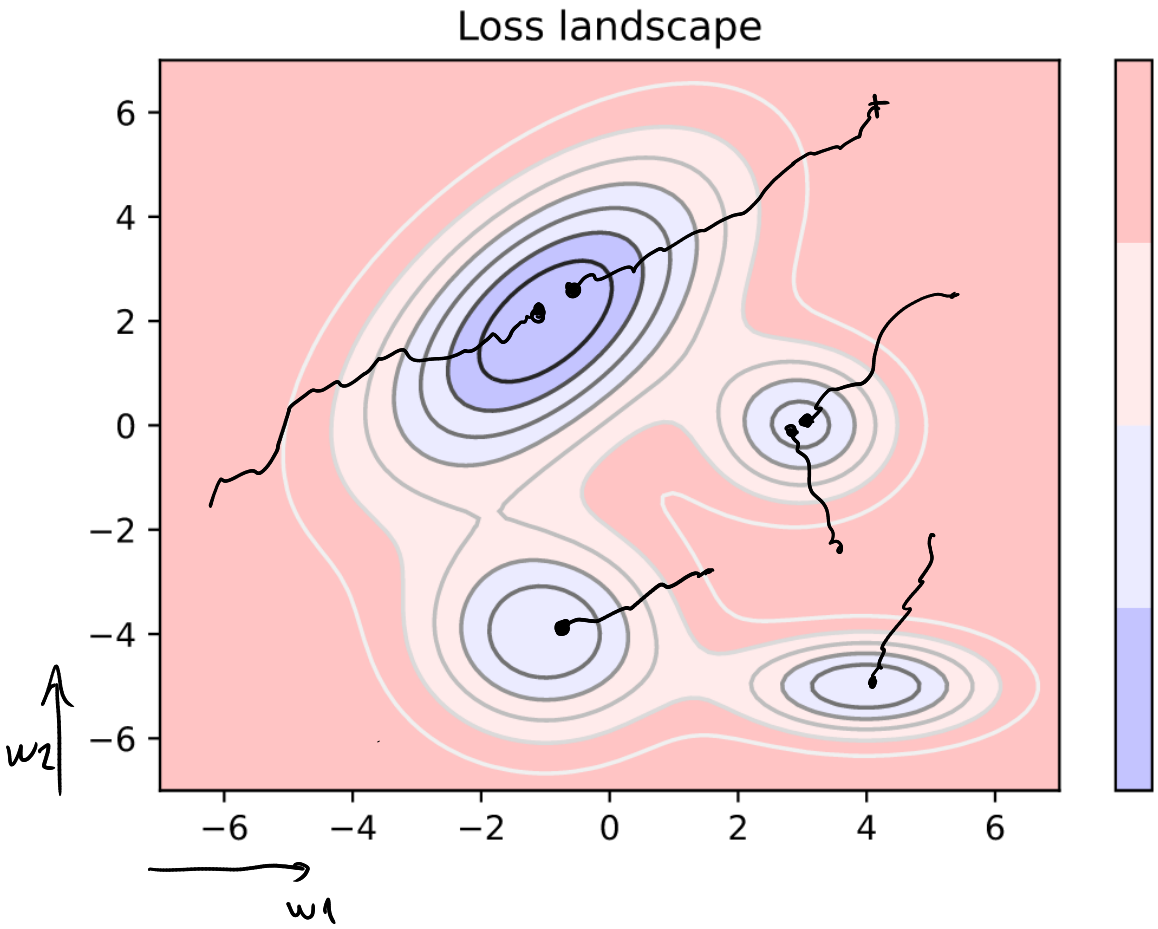
- Dataset shift
  - the "target" set is different from the training set
  - out of distribution situation
  - .
- Solution
  - Unsupervised domain adaptation (UDA)
    - use unlabeled target data to adapt
  - Usual approach
    - reduce the discrepancy between source and target datasets
    - a natural fit for the Optimal Transport theory
    - or, tune the classifier to become certain on data points

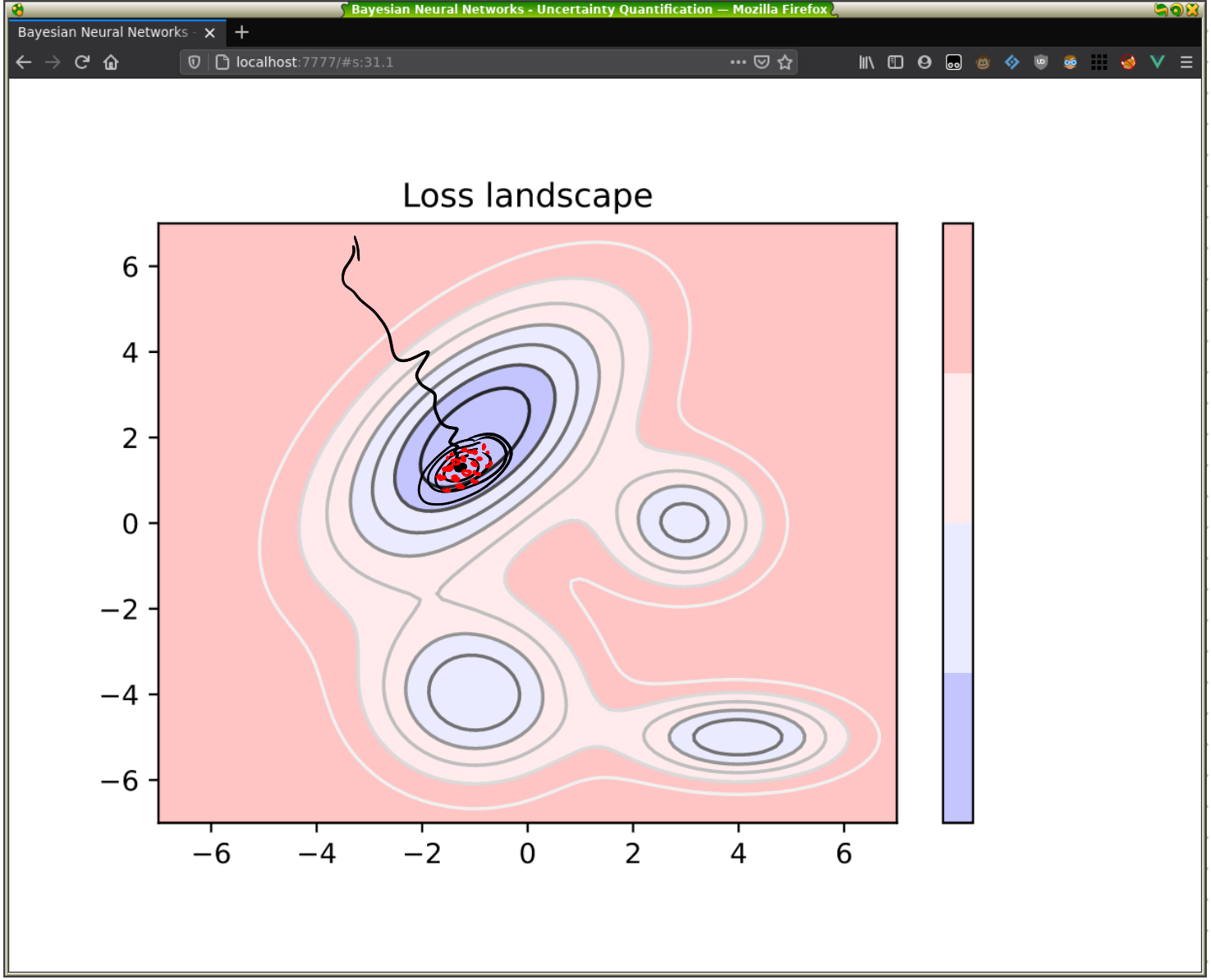


Bayesian Neural Networks - Uncertainty Quantification — Mozilla Firefox

Bayesian Neural Networks

localhost:7777/#s:29




Bayesian Neural Networks - Uncertainty Quantification — Mozilla Firefox
Bayesian Neural Networks
localhost:7777/#s:31.1
Loss landscape
6
4
2
0
−2
−4
−6
−6
−4
−2
0
2
4
6