

# Week 6

# Presentation

PHY 496

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FEBRUARY 22, 2019

# Summary

- ▶ Analyzed the impact of different numbers of iterations for prediction distributions
- ▶ Determined how the prediction quality changes when using less training data
- ▶ Measured how the prediction distributions change during the training process
- ▶ Started experimenting with the Hamiltonian Monte Carlo algorithm

# Variable Iterations

|                   | Inside 1<br>SD | Inside 2<br>SDs | Inside 3<br>SD3 | Outside of 3<br>SDs | Below min | Above max | Percent<br>Error |
|-------------------|----------------|-----------------|-----------------|---------------------|-----------|-----------|------------------|
| 100 Iterations    | 25.17          | 47.43           | 65.23           | 34.77               | 12.41     | 30.67     | 11.43            |
| 1000 Iterations   | 25.41          | 48.07           | 65.65           | 34.35               | 8.99      | 22.08     | 11.40            |
| 10,000 Iterations | 25.48          | 48.08           | 65.86           | 34.14               | 7.04      | 16.75     | 11.40            |

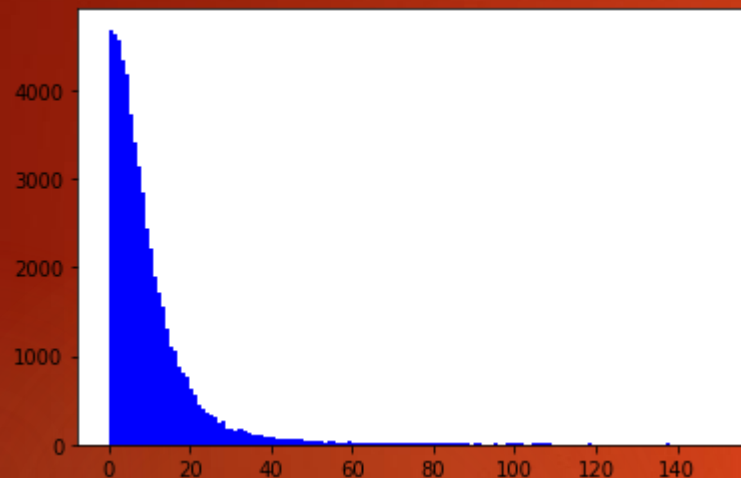
# Variable Training Data

| Training Percent | Inside 1 SD | Inside 2 SDs | Inside 3 SD3 | Outside of 3 SDs | Below min | Above max | Percent Error |
|------------------|-------------|--------------|--------------|------------------|-----------|-----------|---------------|
| 40               | 14.13       | 27.94        | 40.67        | 59.33            | 19.57     | 36.97     | 10.88         |
| 50               | 11.38       | 22.51        | 33.19        | 66.81            | 33.88     | 30.41     | 10.3          |
| 60               | 9.29        | 18.67        | 27.81        | 72.19            | 37.30     | 32.69     | 10.9          |
| 70               | 7.66        | 15.24        | 22.53        | 77.47            | 42.80     | 32.88     | 10.56         |
| 80               | 7.02        | 13.70        | 20.63        | 79.37            | 26.30     | 51.56     | 10.56         |
| 90               | 5.92        | 11.57        | 17.49        | 82.51            | 48.77     | 32.38     | 10.55         |

# Variable Training Data % Error

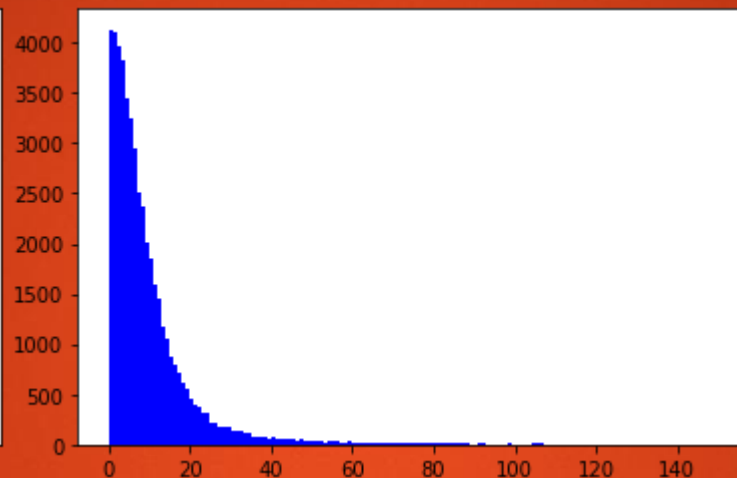
40%

Percent Error



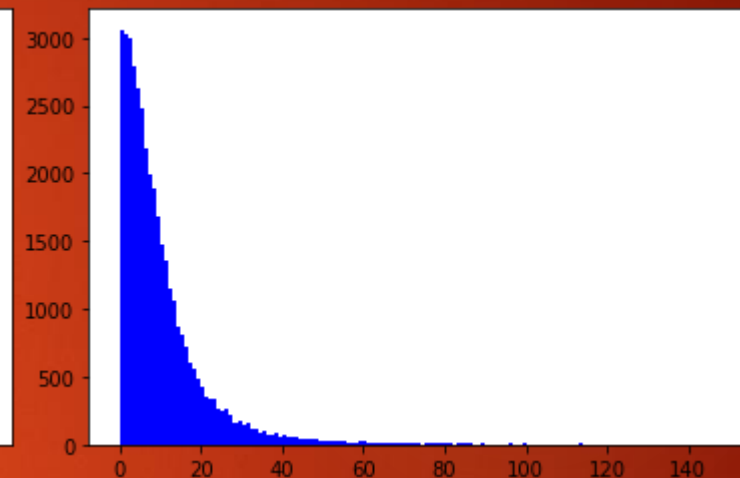
50%

Percent Error



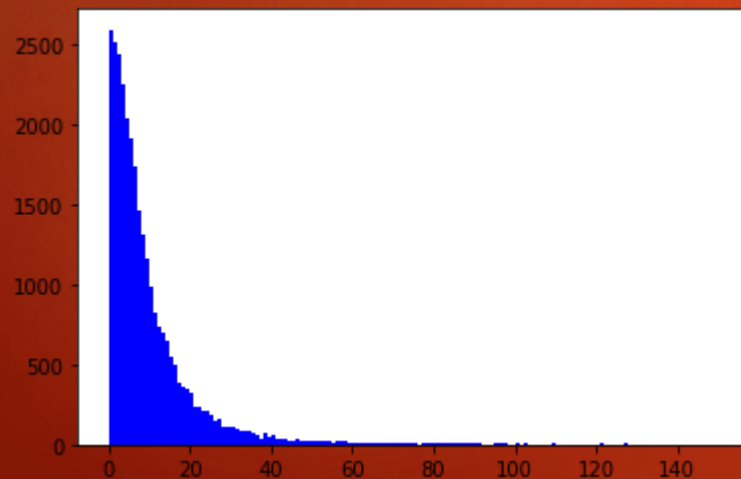
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Percent Error



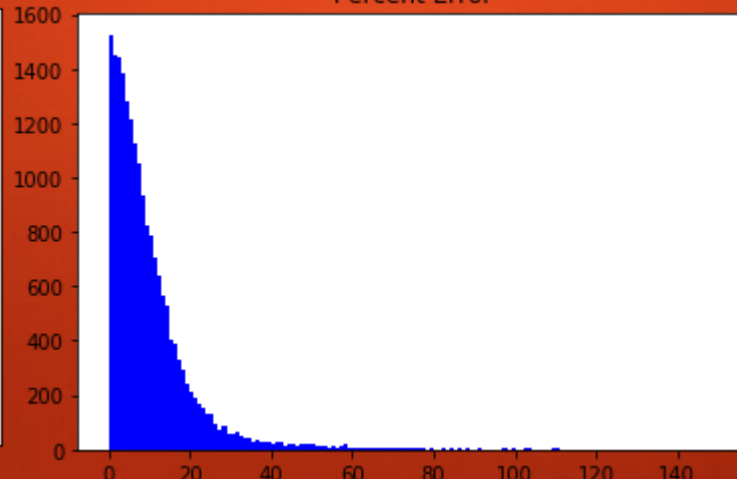
70%

Percent Error



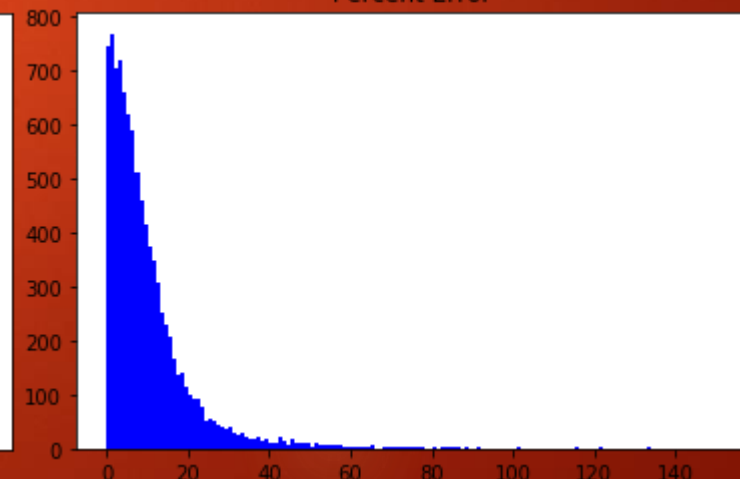
80%

Percent Error



90%

Percent Error



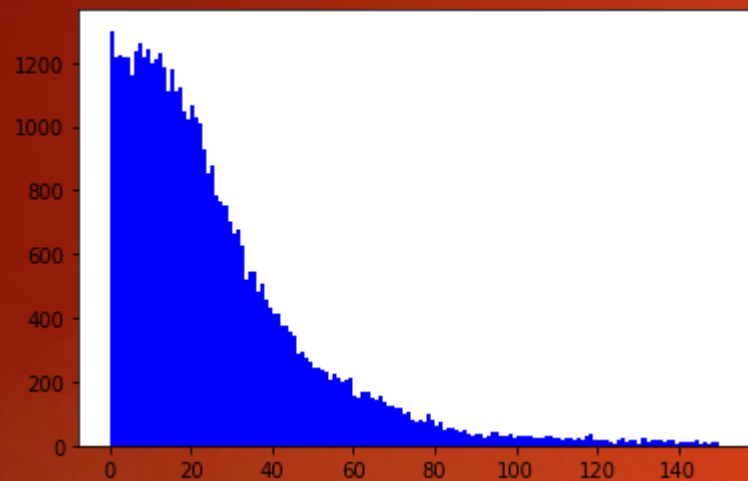
# Variable Epochs

| Epoch | Inside 1 SD | Inside 2 SDs | Inside 3 SD3 | Outside of 3 SDs | Below min | Above max | Percent Error |
|-------|-------------|--------------|--------------|------------------|-----------|-----------|---------------|
| 20    | 81.19       | 96.11        | 98.75        | 1.25             | 0.45      | 0.70      | 29.97         |
| 40    | 56.44       | 84.14        | 93.70        | 6.30             | 2.68      | 2.80      | 20.35         |
| 60    | 41.10       | 70.03        | 86.02        | 13.98            | 4.72      | 7.40      | 16.21         |
| 80    | 30.10       | 55.11        | 73.32        | 26.68            | 7.95      | 15.74     | 14.71         |
| 100   | 24.07       | 45.18        | 61.63        | 38.37            | 11.90     | 23.34     | 14.22         |
| 200   | 11.46       | 23.00        | 3362         | 66.38            | 43.26     | 20.73     | 12.94         |

# Variable Epochs % Error

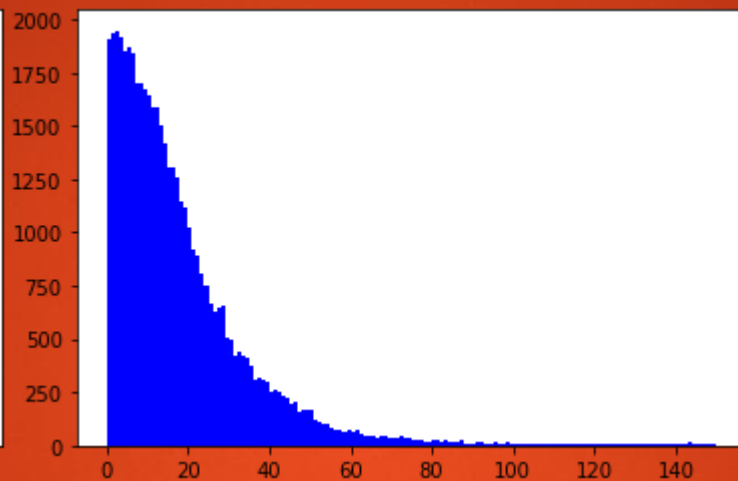
20

Percent Error



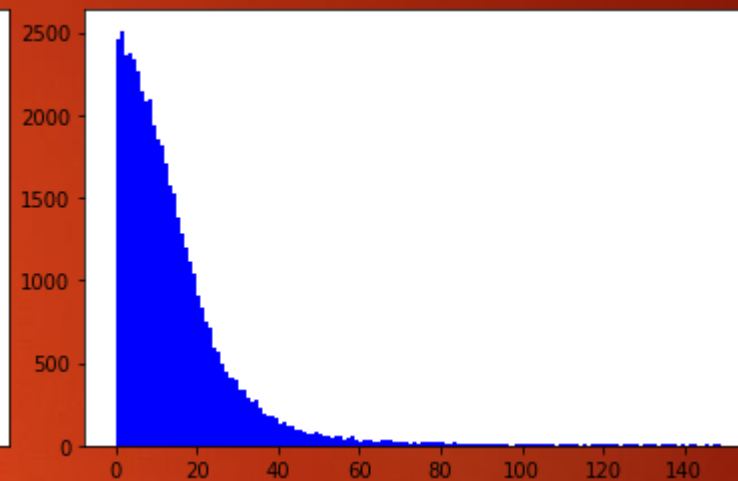
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Percent Error



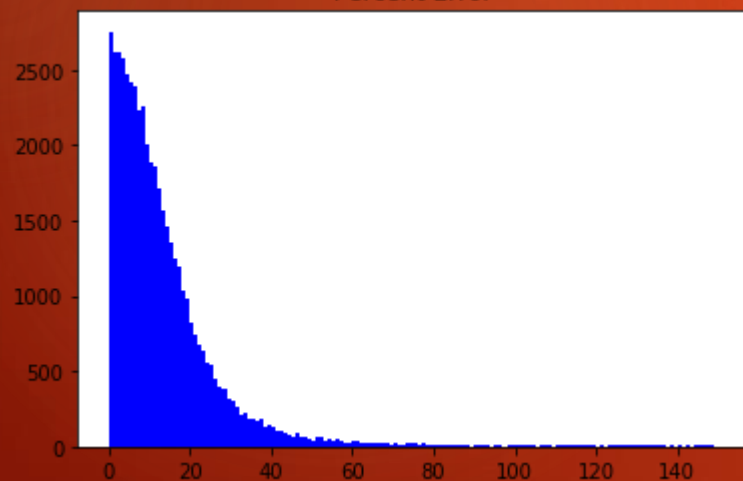
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Percent Error



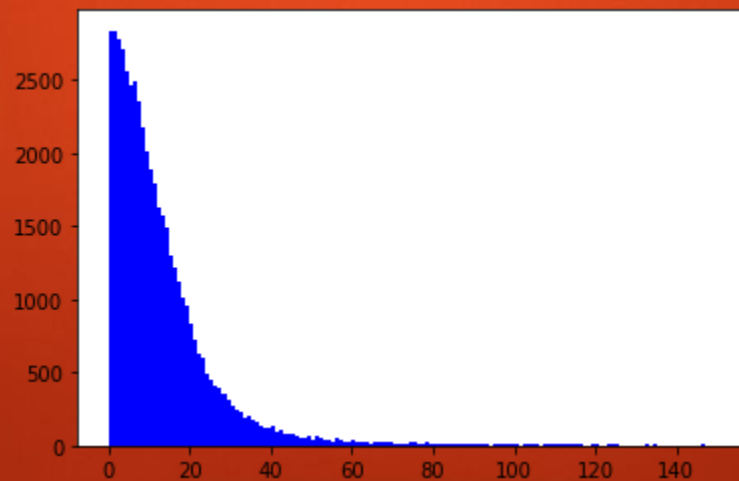
80

Percent Error



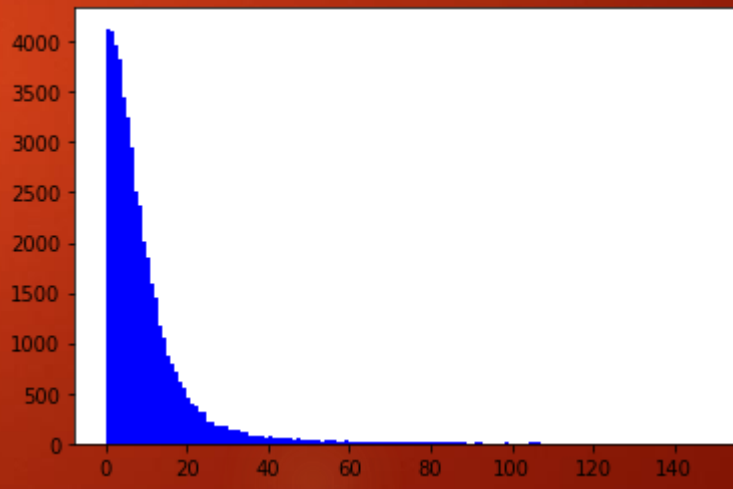
100

Percent Error

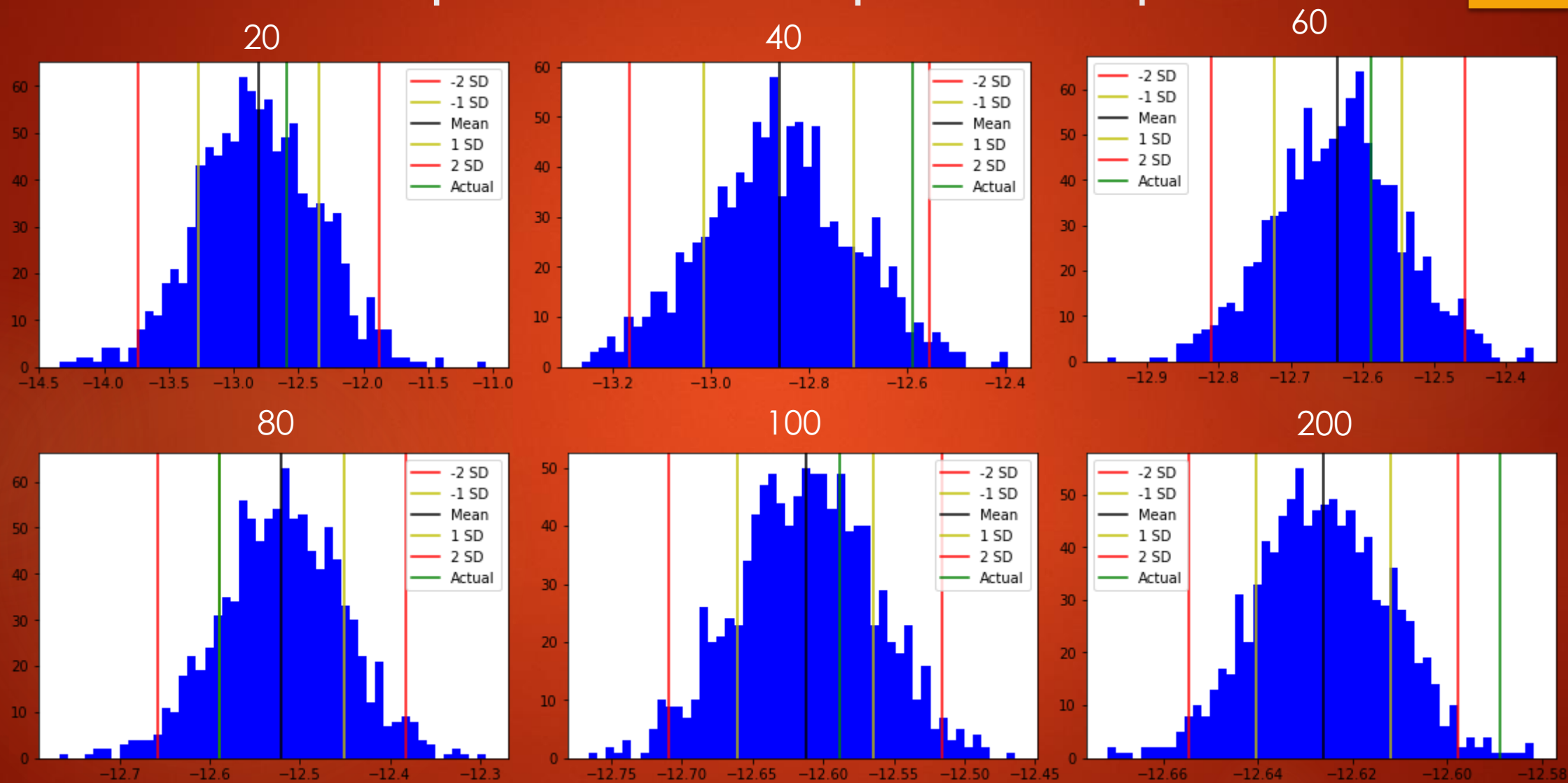


200

Percent Error



# Variable Epochs Sample Output





# Goals for next week

- ▶ Read all of Radford Neal's thesis on Bayesian Neural Networks
- ▶ Construct a basic network from Hamiltonian Monte Carlo
  - ▶ Possibly compare predictions made from this network with the other networks that have been made