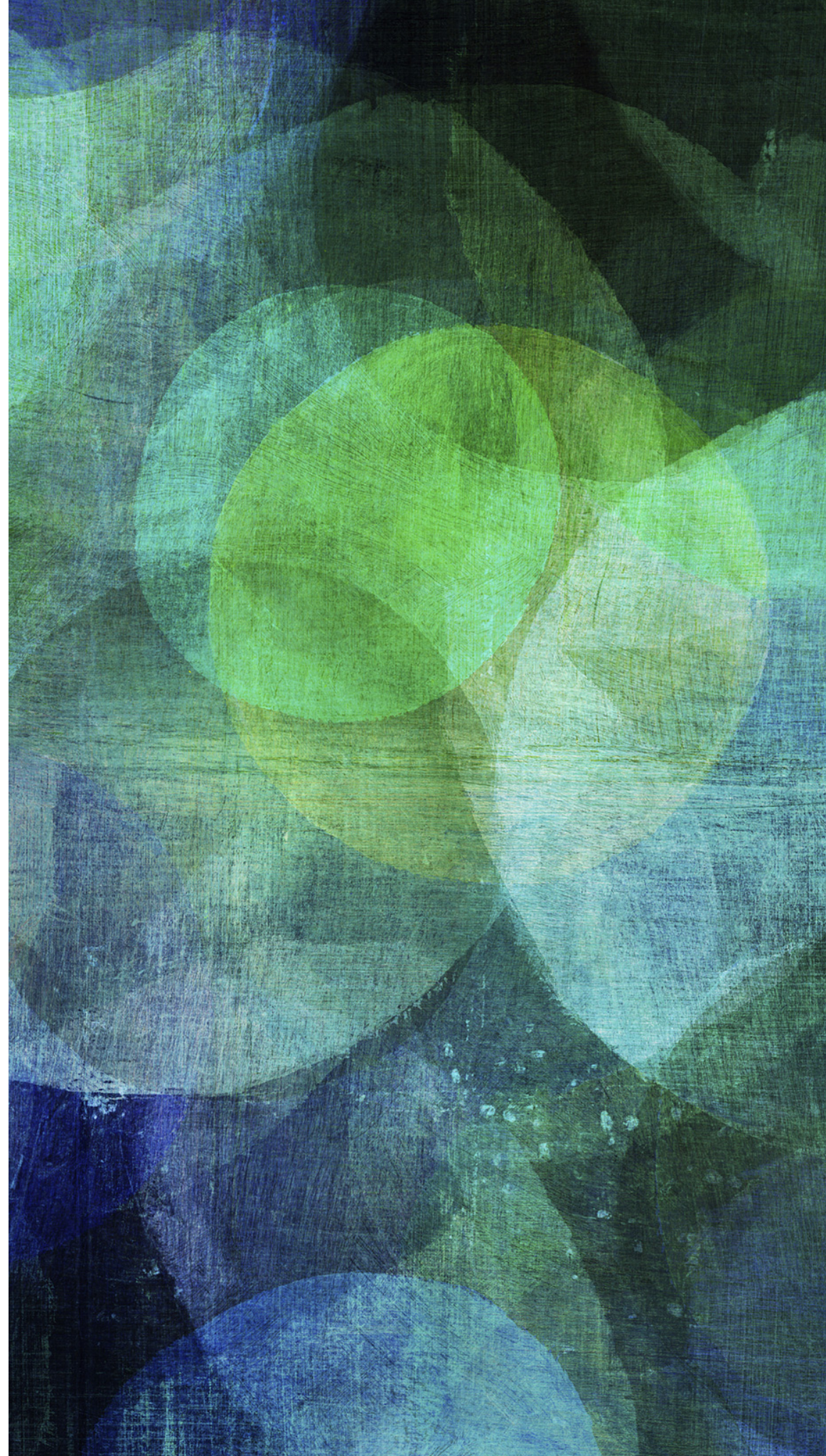# REGRESSION OF BOSTON HOUSE PRICES

Brownlee Ch. 12

Yifan Jiang

OUTLINE

➤ Problem Introduction

➤ Network Model & Standardization

➤ Topology Tuning (Larger? | Wider?)

➤ Experiment results

PROBLEM INTRODUCTION

➤ Regression predictive problem

➤ Input: Boston suburbs properties (13 variables)

➤ Output: Price of houses in suburbs (in 1000s dollars)

➤ Goal: Predict the price of a residential area

BOSTON HOUSE PRICE DATASET

CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0.00632	18.00	2.310	0	0.5380	6.5750	65.20	4.0900	1	296.0	15.30	396.90	4.98	24.00
0.02731	0.00	7.070	0	0.4690	6.4210	78.90	4.9671	2	242.0	17.80	396.90	9.14	21.60
0.02729	0.00	7.070	0	0.4690	7.1850	61.10	4.9671	2	242.0	17.80	392.83	4.03	34.70
0.03237	0.00	2.180	0	0.4580	6.9980	45.80	6.0622	3	222.0	18.70	394.63	2.94	33.40
0.06905	0.00	2.180	0	0.4580	7.1470	54.20	6.0622	3	222.0	18.70	396.90	5.33	36.20

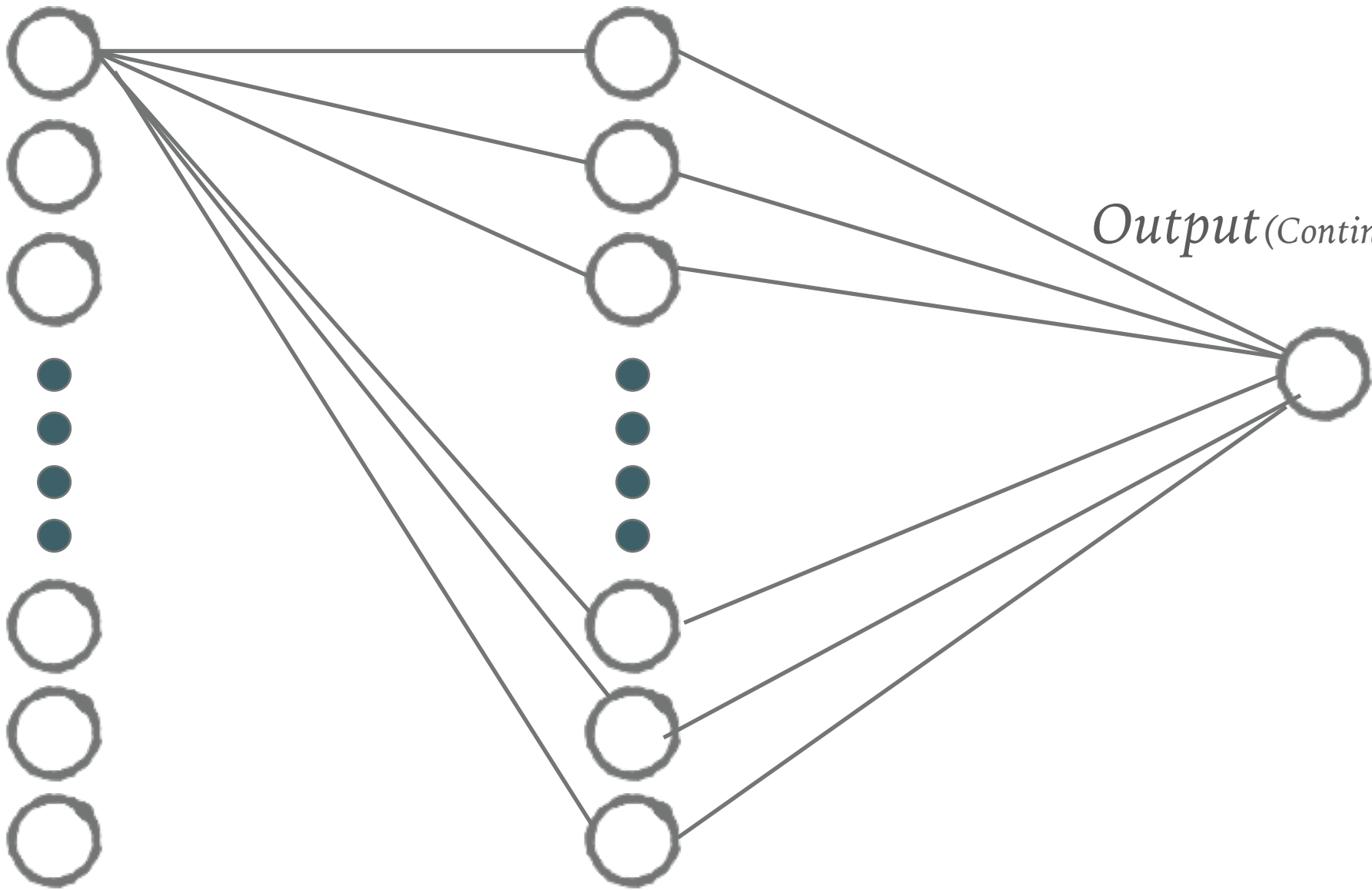*Median value of owner-occupied homes in $1000*

Performance evaluated by Mean Square Error (MSE)

NETWORK MODEL

Input *(13 variables representing suburb properties)*
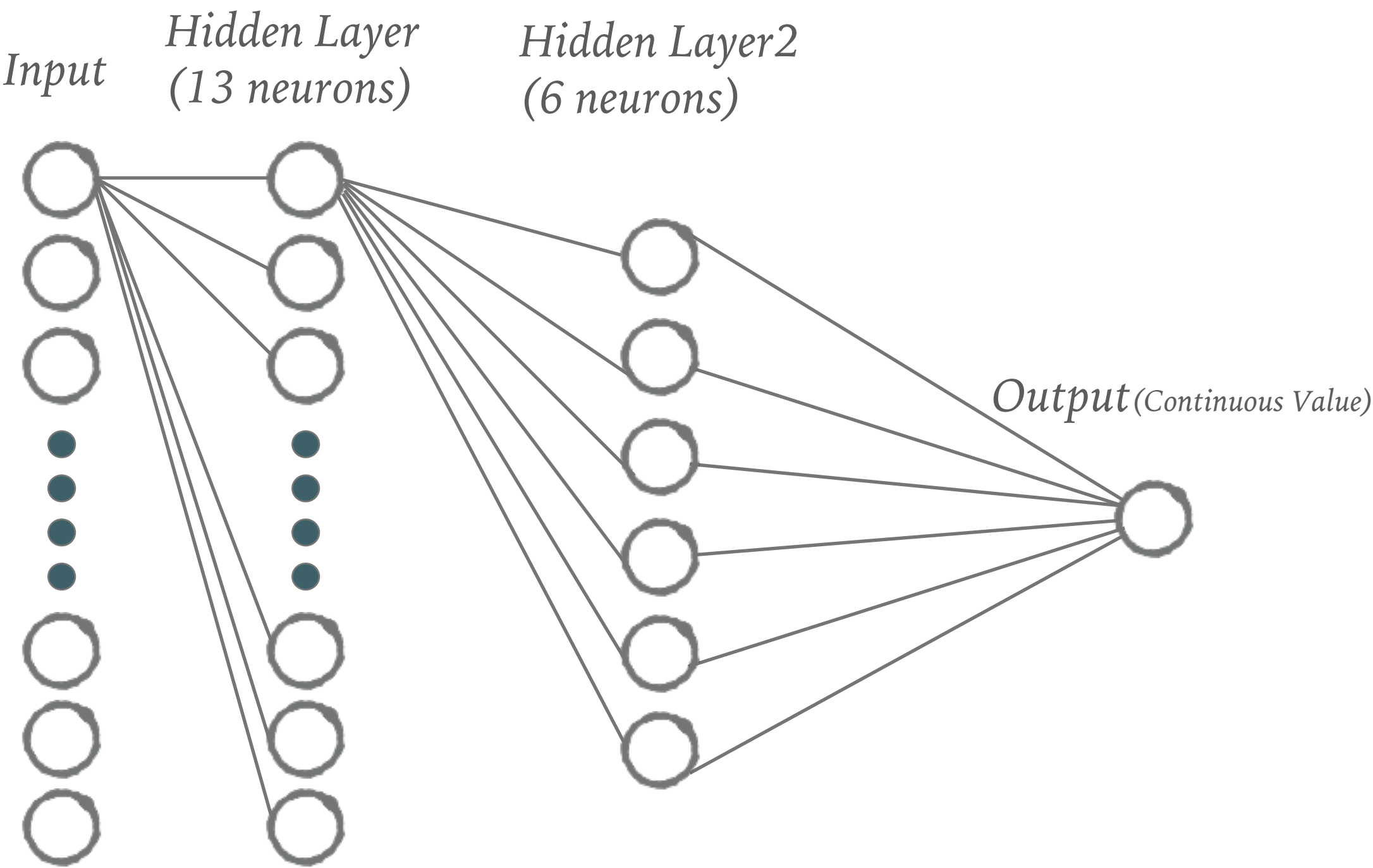
Hidden Layer (13 neurons)

Output *(Continuous Value)*

STANDARDIZATION

CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0.00632	18.00	2.310	0	0.5380	6.5750	65.20	4.0900	1	296.0	15.30	396.90	4.98	24.00
0.02731	0.00	7.070	0	0.4690	6.4210	78.90	4.9671	2	242.0	17.80	396.90	9.14	21.60
0.02729	0.00	7.070	0	0.4690	7.1850	61.10	4.9671	2	242.0	17.80	392.83	4.03	34.70
0.03237	0.00	2.180	0	0.4580	6.9980	45.80	6.0622	3	222.0	18.70	394.63	2.94	33.40
0.06905	0.00	2.180	0	0.4580	7.1470	54.20	6.0622	3	222.0	18.70	396.90	5.33	36.20

TOPOLOGY TUNING– LARGER

Input

Hidden Layer
(13 neurons)

Hidden Layer2
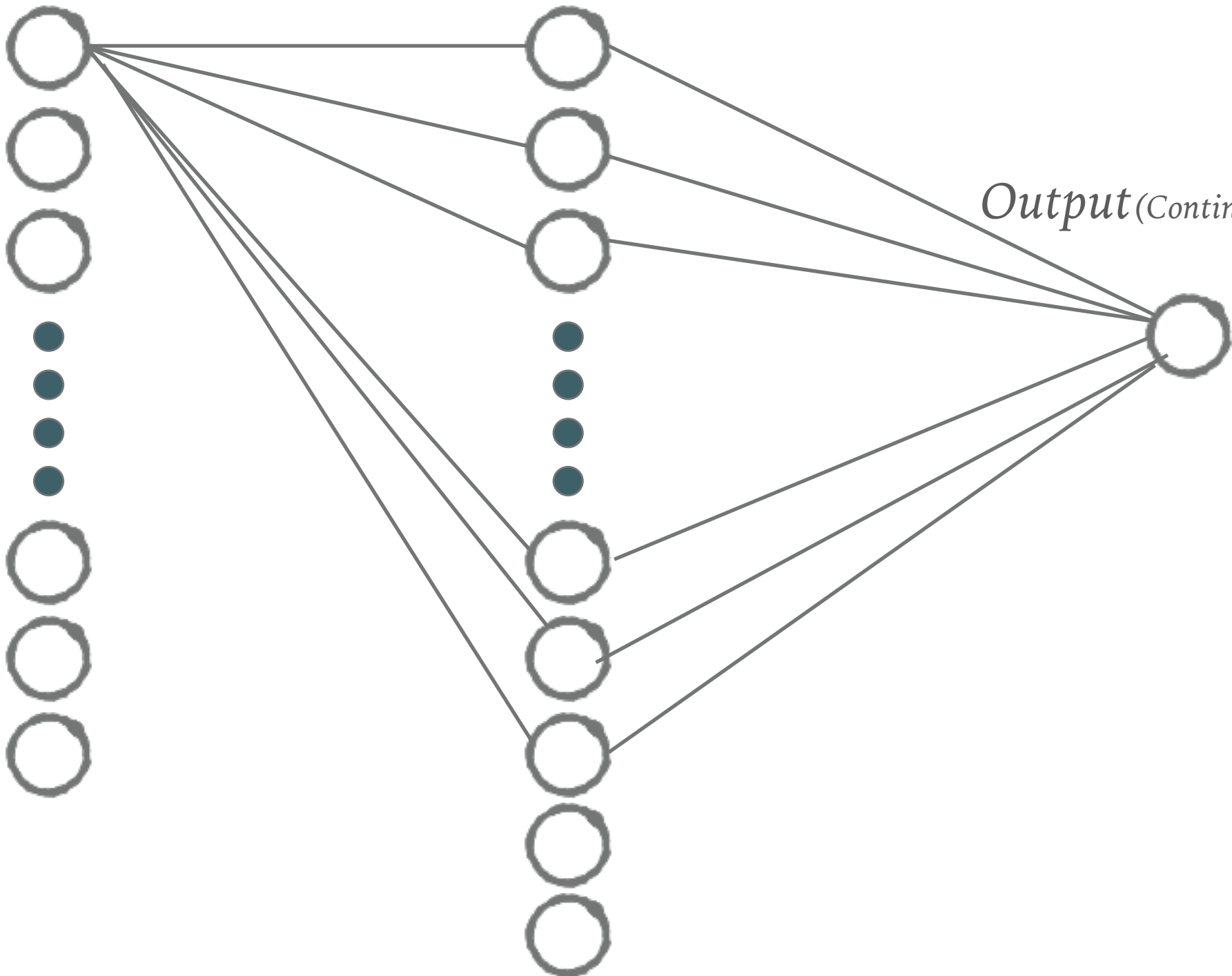*(6 neurons)*

Output (Continuous Value)

TOPOLOGY TUNING – WIDER

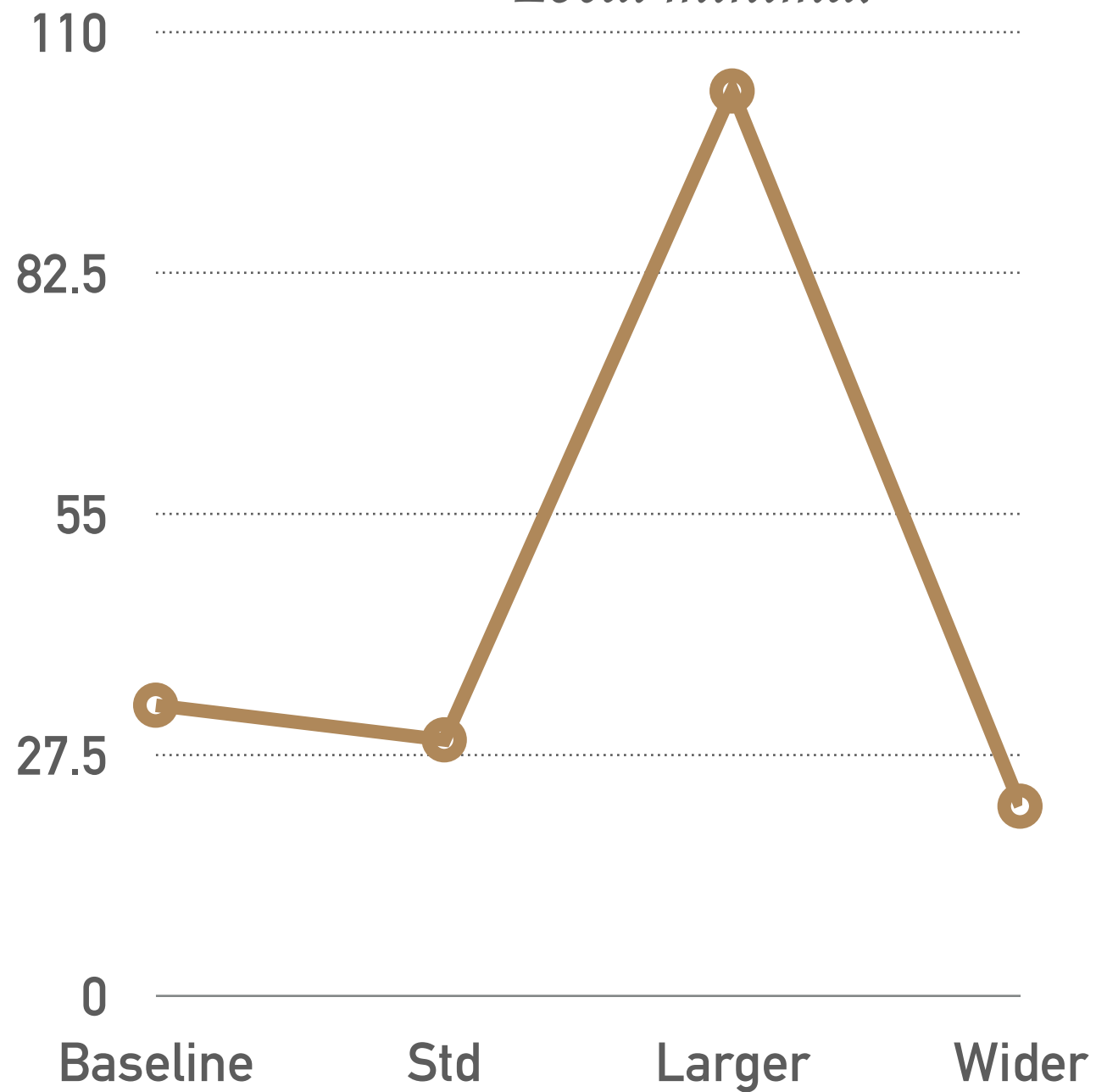*Input* (13 variables representing suburb properties)

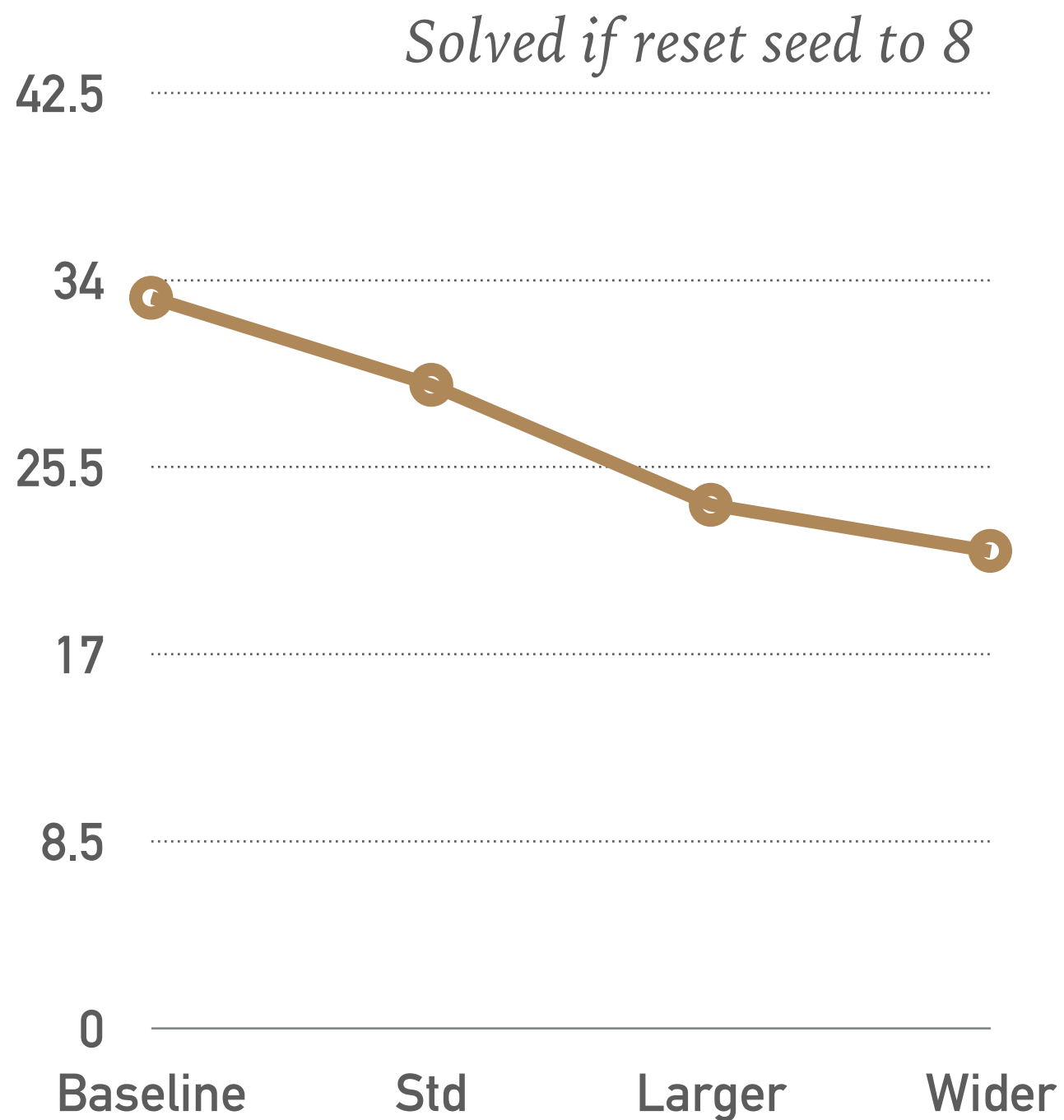*Hidden Layer* (**20** neurons)

Output (Continuous Value)

What happens here?
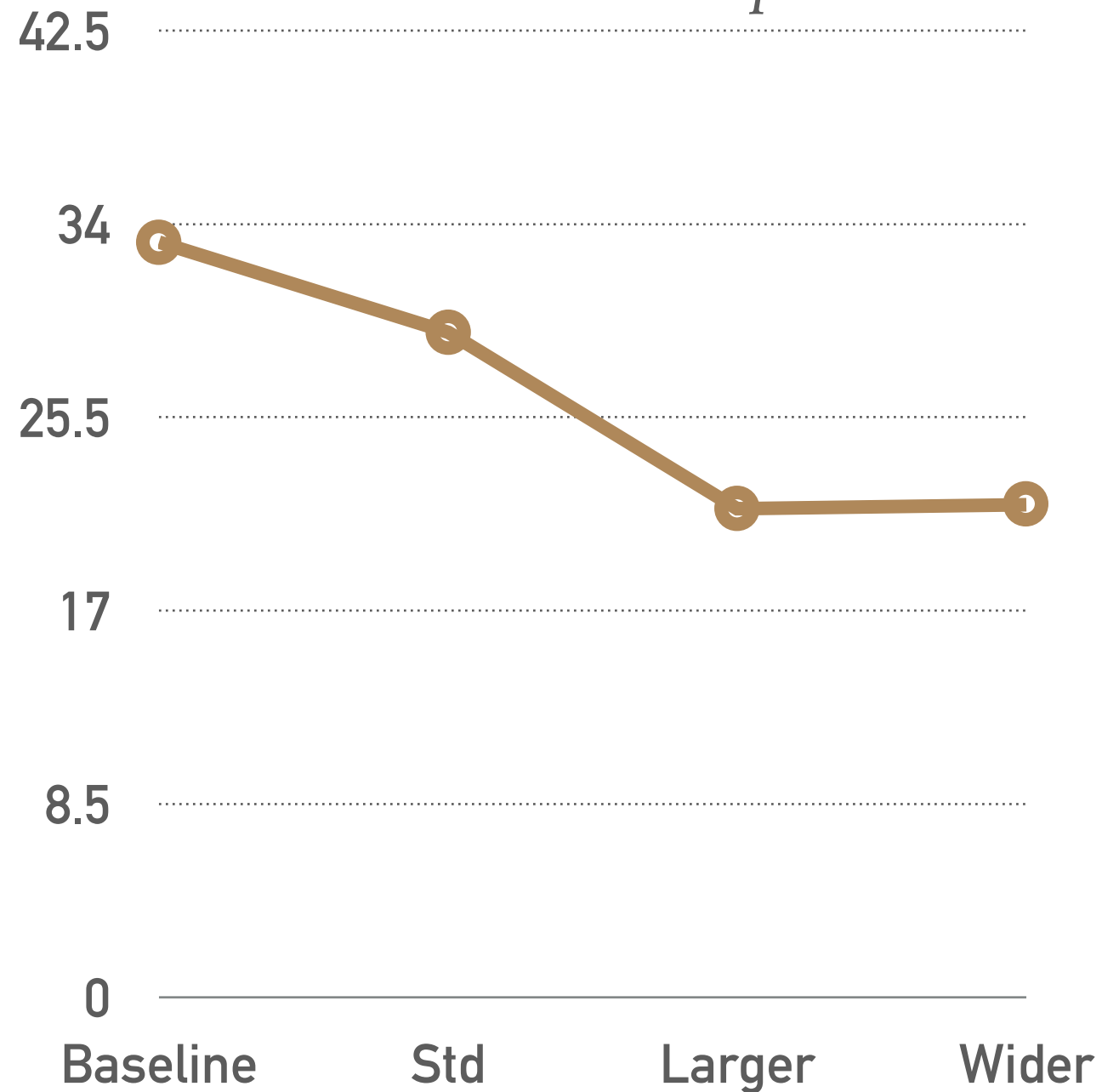*Local minima?*

EXPERIMENT RESULTS

➤ activation: Relu

➤ epoch: 50

➤ mini-batch size: 5

➤ cross-validation folds: 10

➤ seed: 7

Solved if reset seed to 8

42.5

34

25.5

17

8.5

0

Baseline   Std   Larger   Wider

EXPERIMENT RESULTS

➤ activation: Relu

➤ epoch: 50 for Baseline & Wider; 100 for Std & Larger

➤ mini-batch size: 5

➤ cross-validation folds: 10

➤ seed: 7

Or increase epoch to 60

EXPERIMENT RESULTS

➤ activation: Relu

➤ epoch: 50 for Baseline & Wider; 100 for Std & Larger

➤ mini-batch size: 5

➤ cross-validation folds: 10

➤ seed: 7
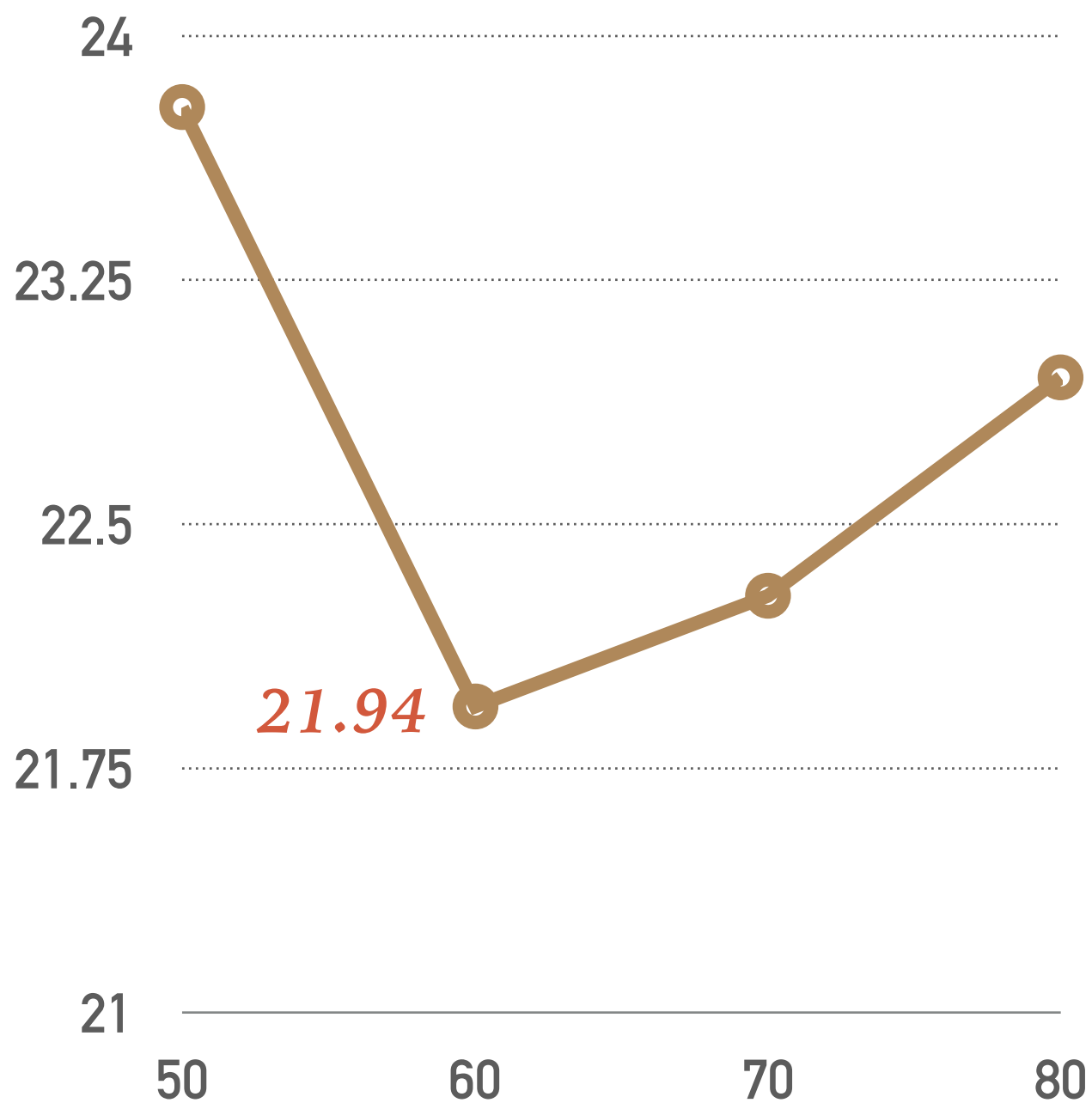
EXPERIMENT RESULTS (LARGE)

➤ activation: Relu

➤ epoch: 50, 60, 70, 80
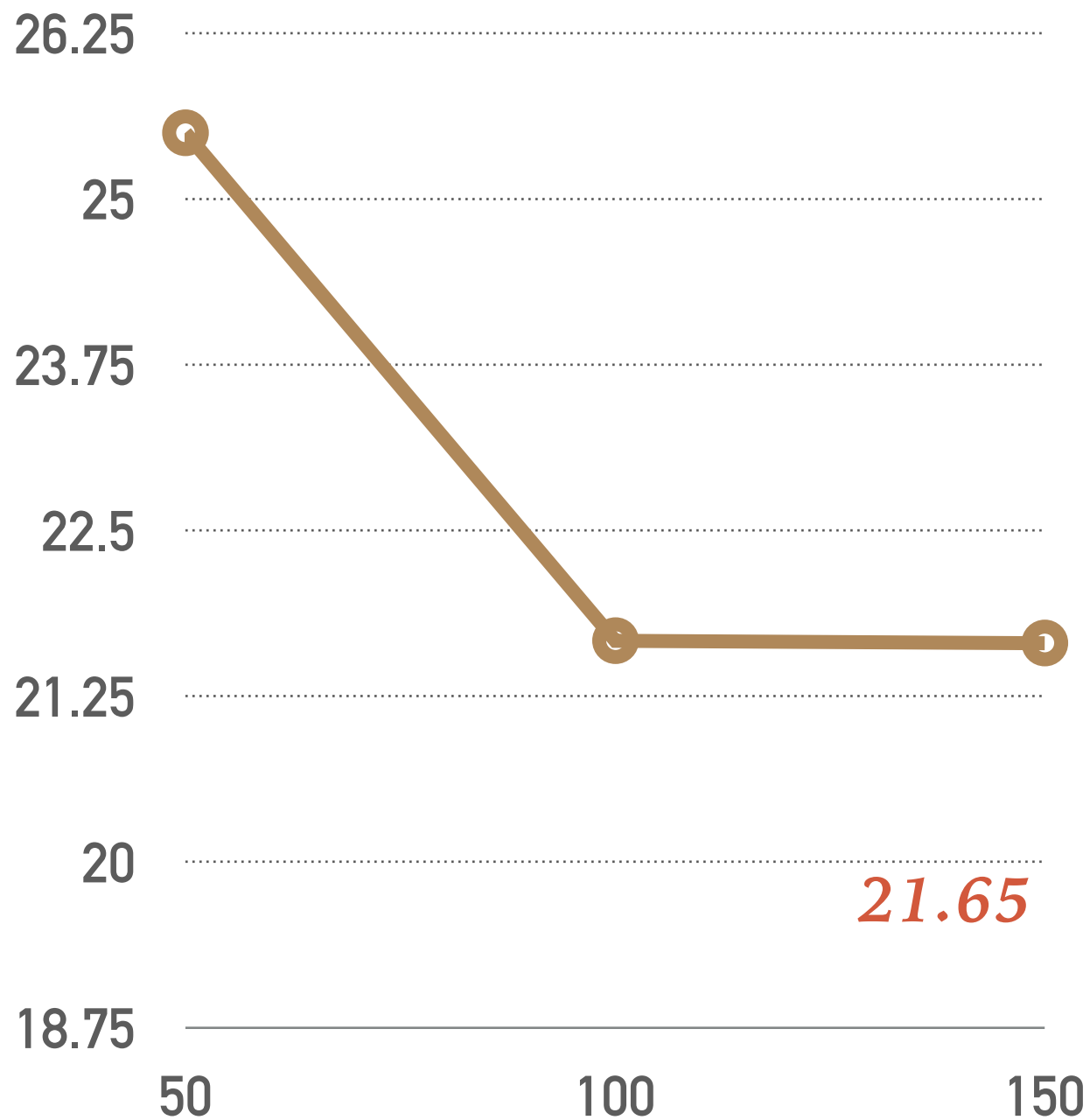
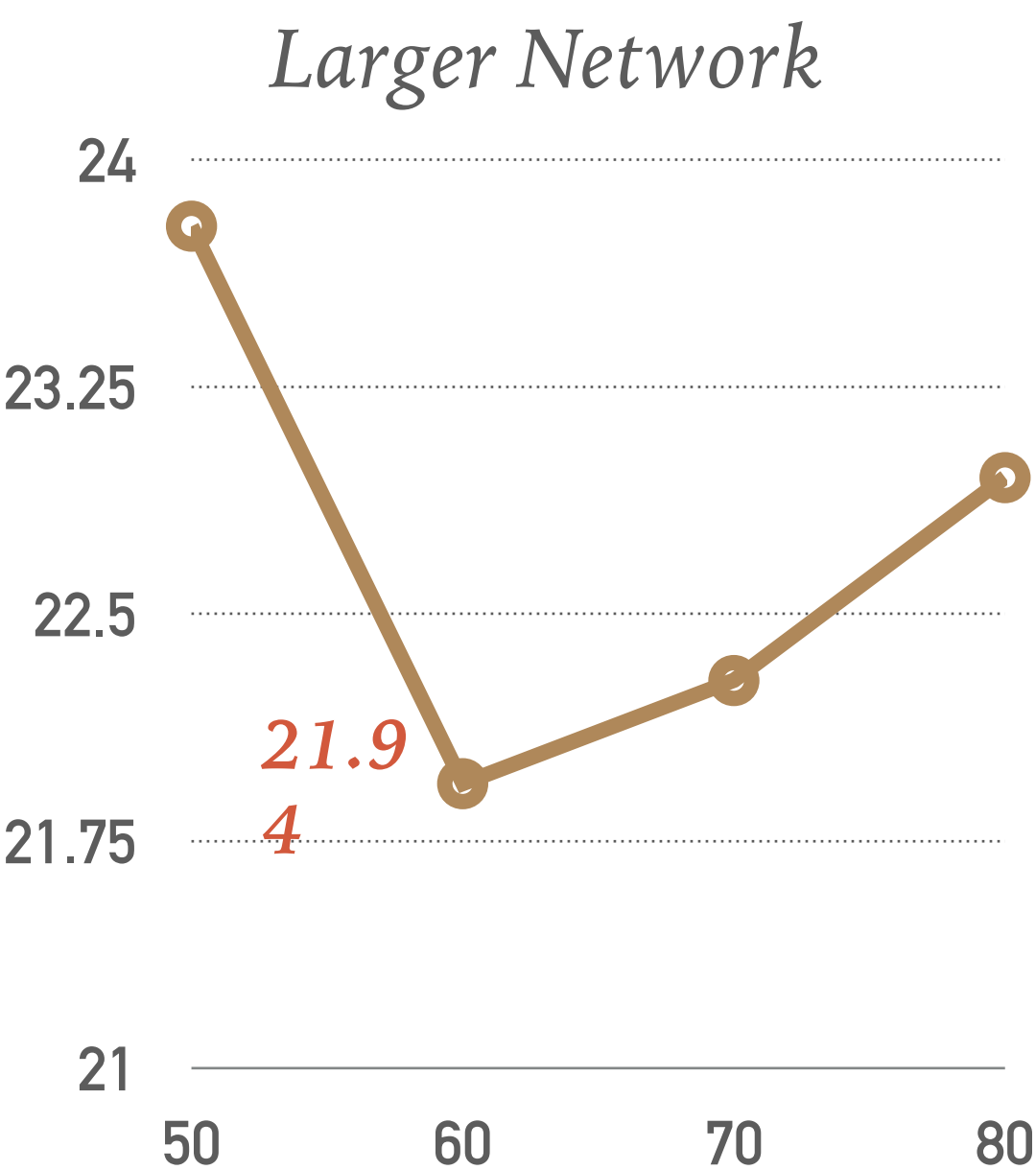➤ mini-batch size: 5
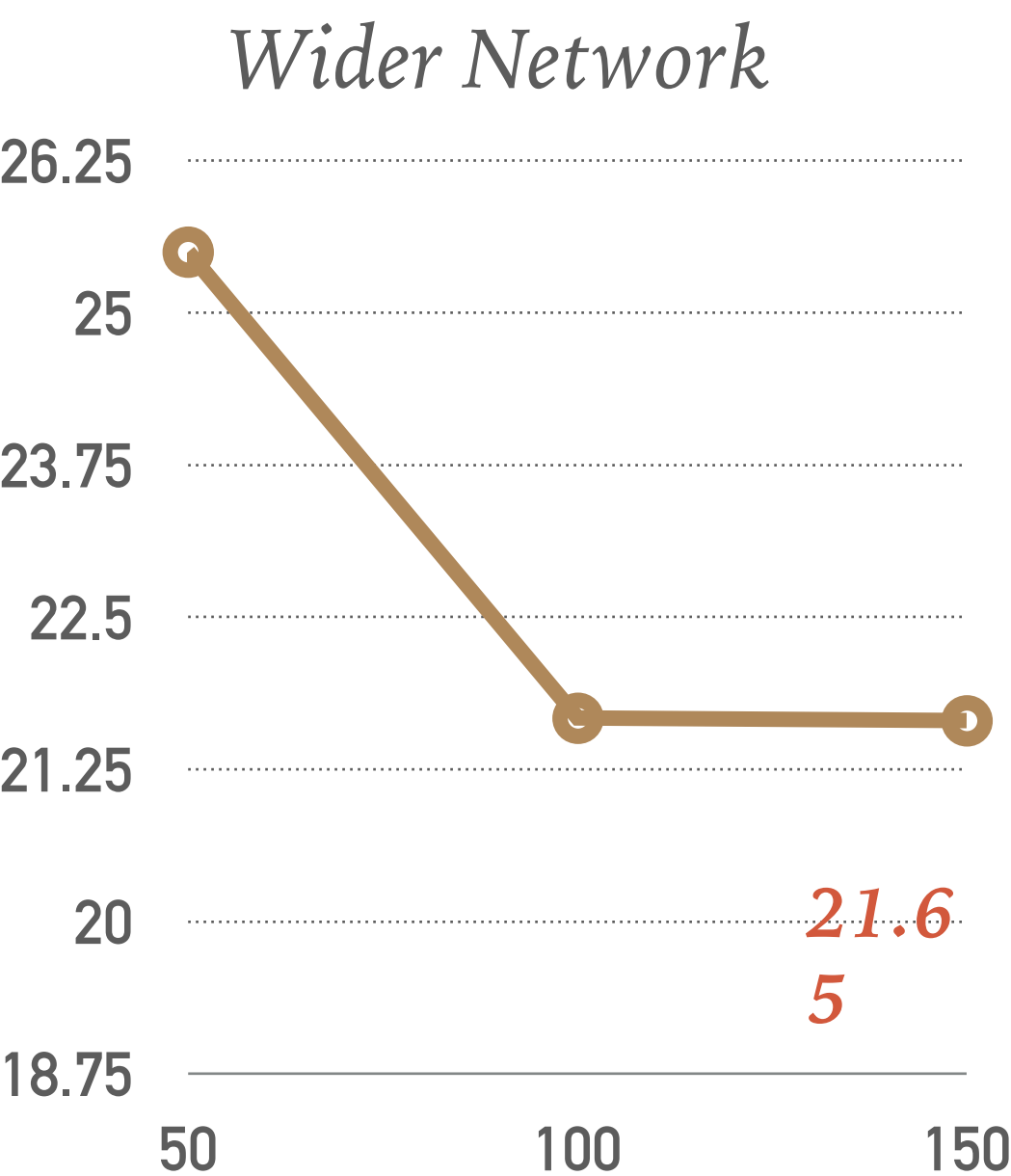
➤ cross-validation folds: 10

➤ seed: 8

EXPERIMENT RESULTS (WIDE)

➤ activation: Relu

➤ epoch: 50, 100, 150

➤ mini-batch size: 5

➤ cross-validation folds: 10

➤ seed: 7

EXPERIMENT RESULTS

Wider Network

21.65

Larger Network

21.94

Hard to tell which one is better

"

The results demonstrate the importance of **empirical testing** when it comes to developing neural network models

-Brownlee