Exploring Portfolio Returns using Deep Learning

MGMT 590 Machine Learning

Li-Ci (Lilian) Chuang
Su-Tien Lee

Agenda

01 **Problem Statement**
Optimize portfolio

02 **Data Description**
Given Dataset

03 **Model 1**
Sharpe Ratio

04 **Model 2**
R-Square

05 **Lessons Learned**
I Love ML ♡

01

Problem Statement

Problem 1

Given the 58-year portfolio data, what is the highest sharpe ratio we can achieve?

Problem 2

What is the best performance (a.k.a highest R-square) we can achieve with the market return and predictors dataset?

02

Data Description

Model 1

data_Z_eff

Feature matrix X with size 2219316×64

data_R_eff

Cutoff to the output vector with ±0.2 return

data_R_org_eff

Output vector with size 2219316×1

data_group_ind

starting and ending indices of stocks in time t = 1,2, … , T

Model 2

Xs

A small set of predictors (GoyalWelch) available at the beginning of month t

Xl

A large set of predictors (GoyalWelch+ Macro variables) available at the beginning of month t

y

Value-weighted market annual return for month t

RESULT

9.46

Sharpe Ratio

-0.287

R-Square

03

Model 1

STRATEGY

adam, adamax, RMSprop

Optimizer, Learning Rate

 # nodes
 # layers

Model structure

LayerNormalization()
BatchNormalization()

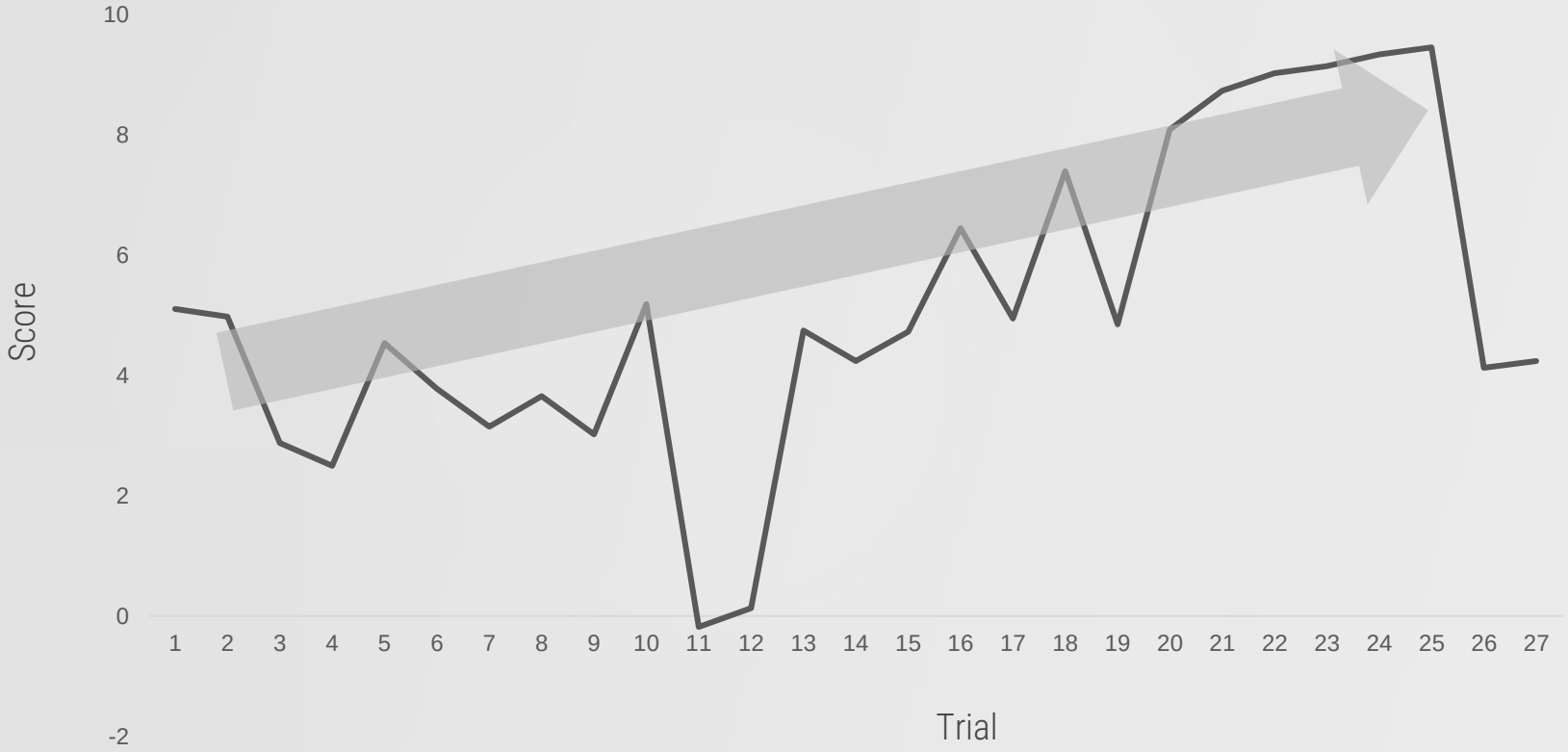
Randomize

 # patience

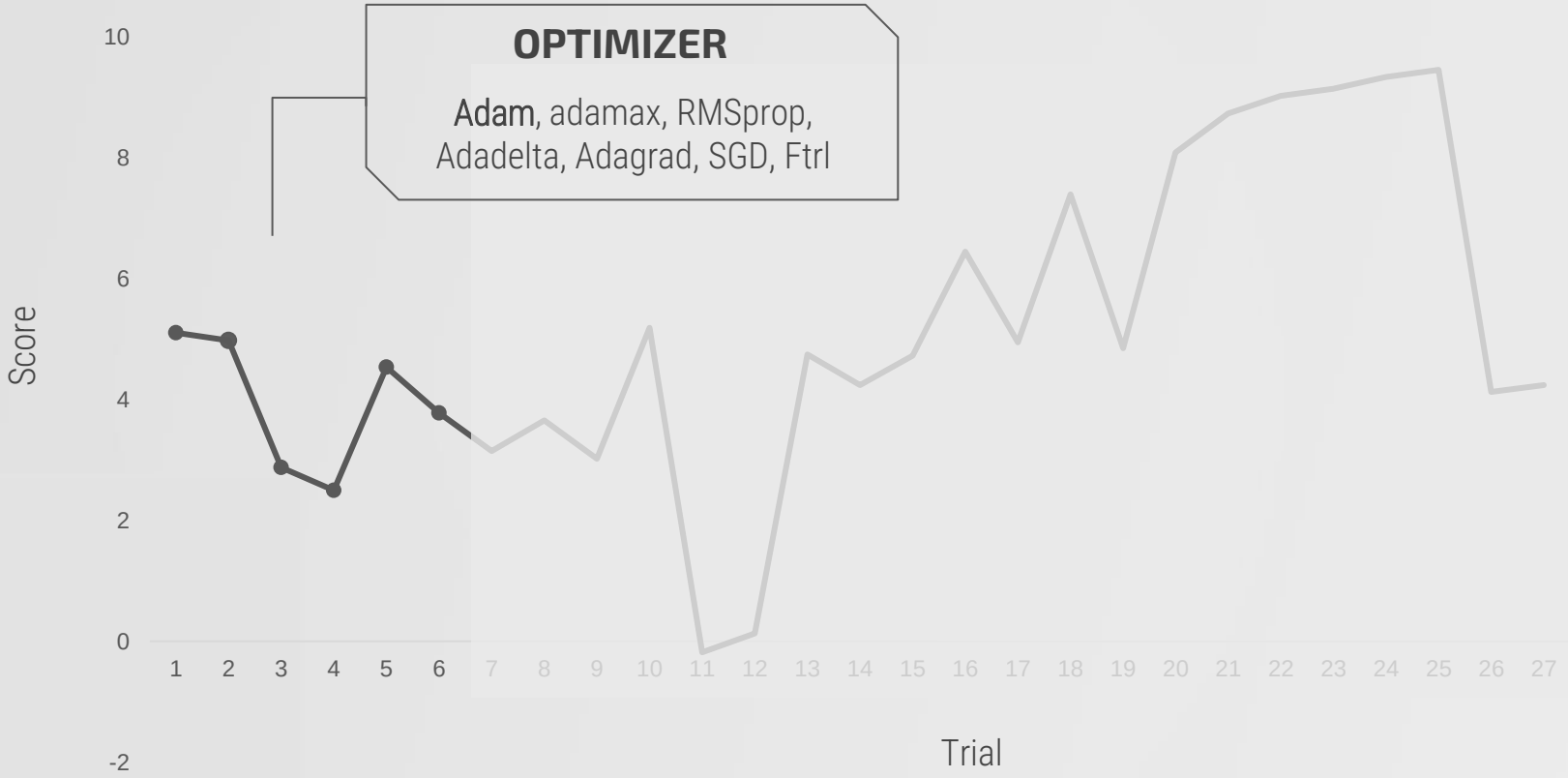
Early stopping

Epoch, Batch Size

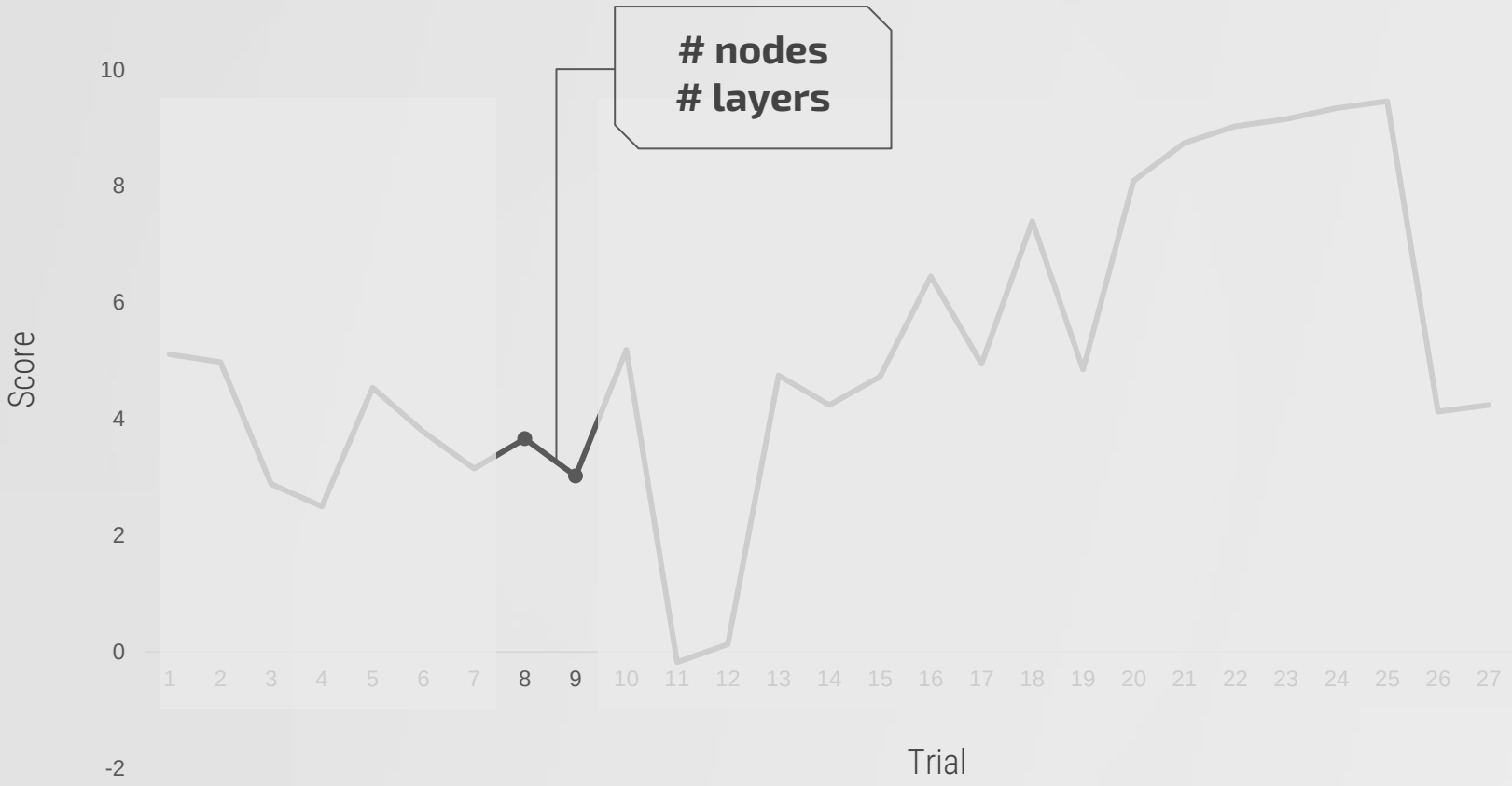
OUR JOURNEY TO SCORE THE BEST RESULT



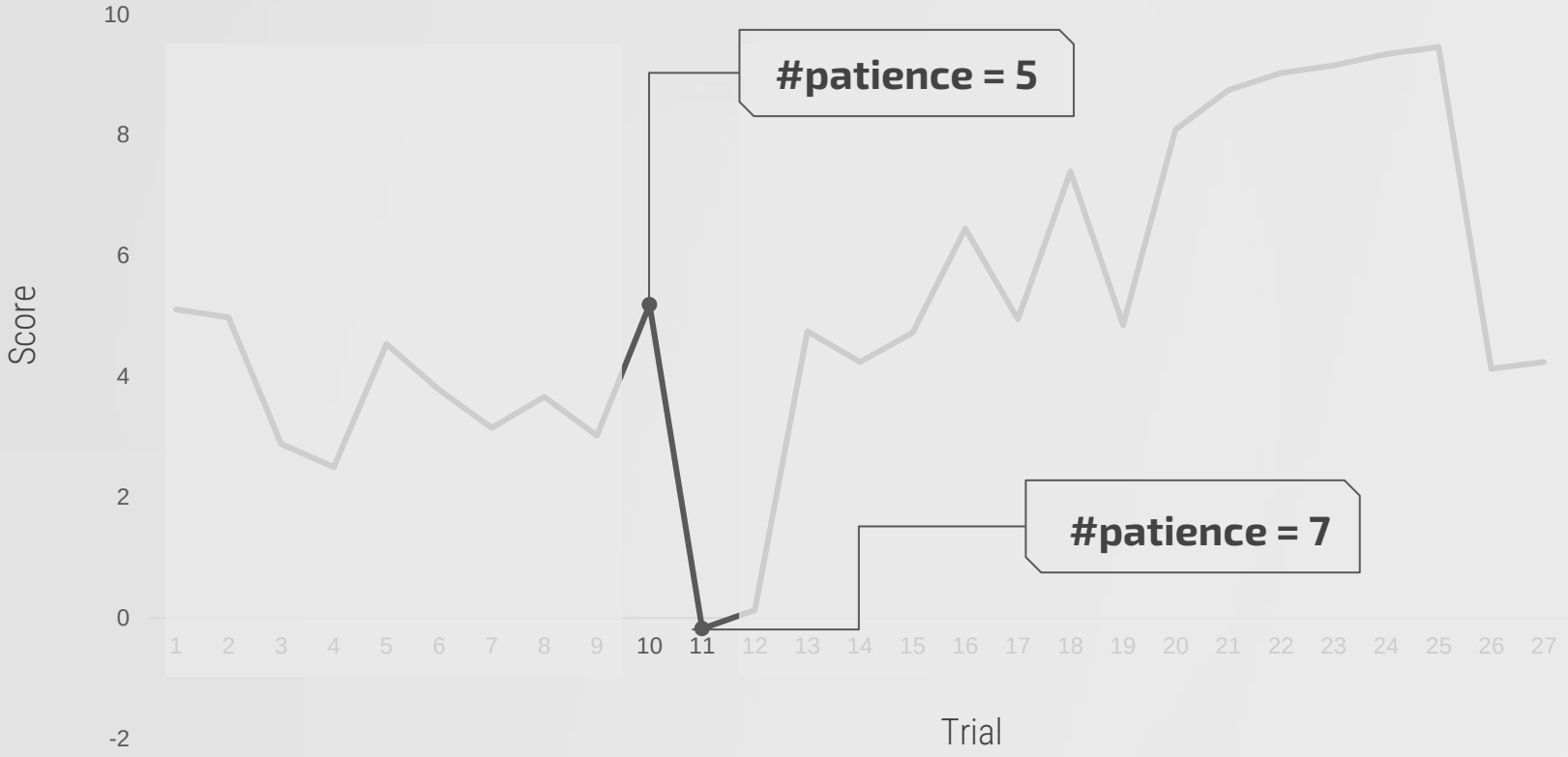
OUR JOURNEY TO SCORE THE BEST RESULT



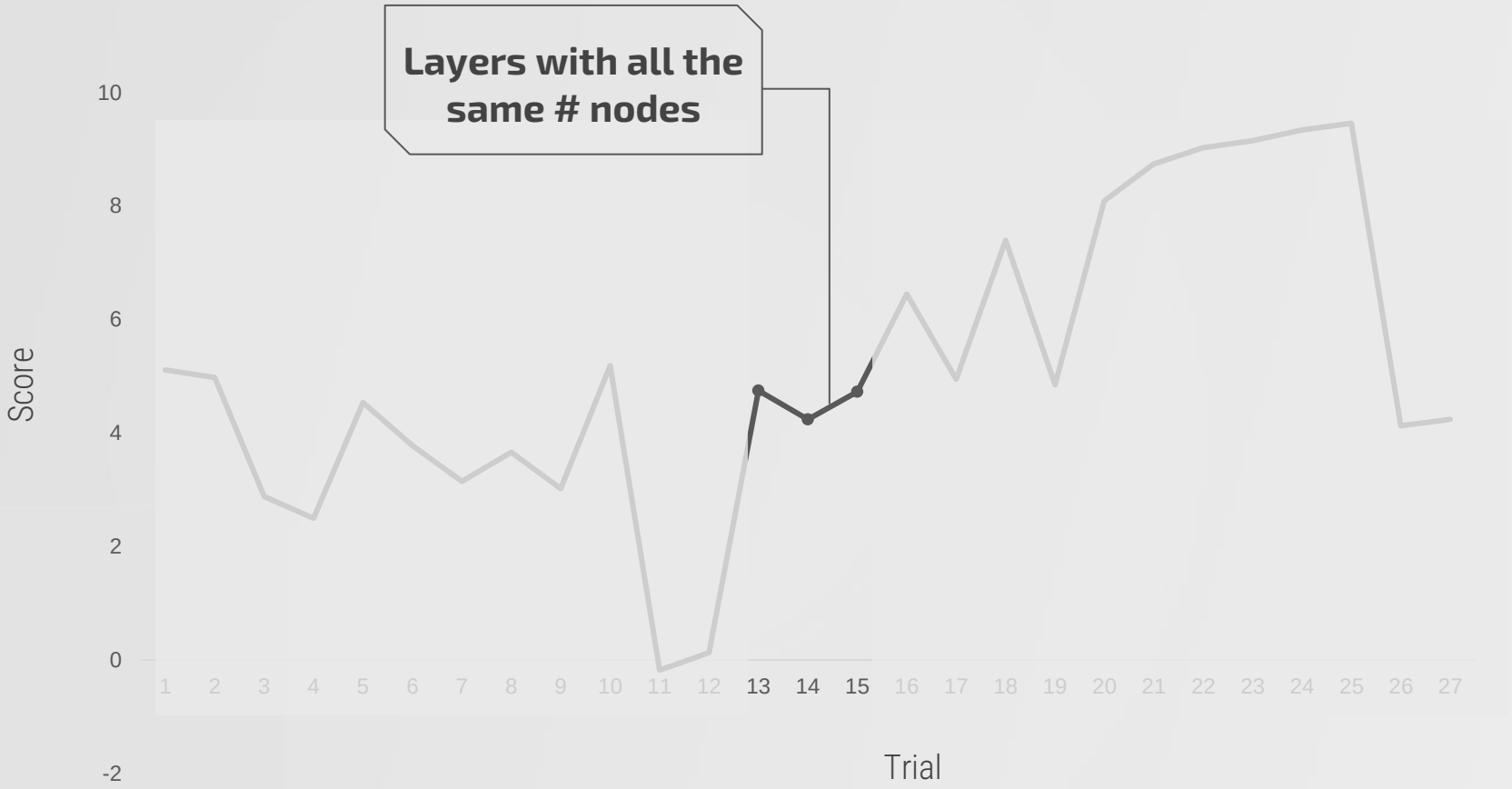
OUR JOURNEY TO SCORE THE BEST RESULT



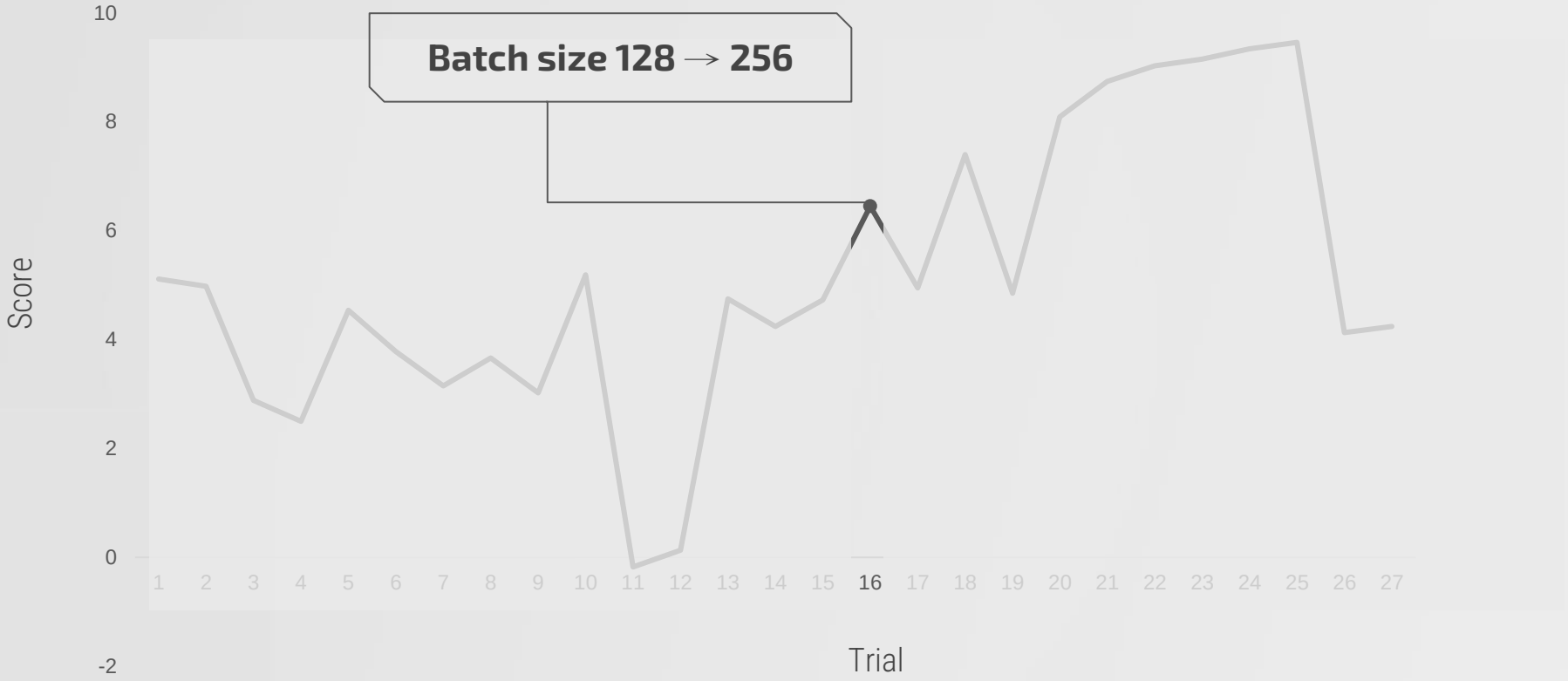
OUR JOURNEY TO SCORE THE BEST RESULT



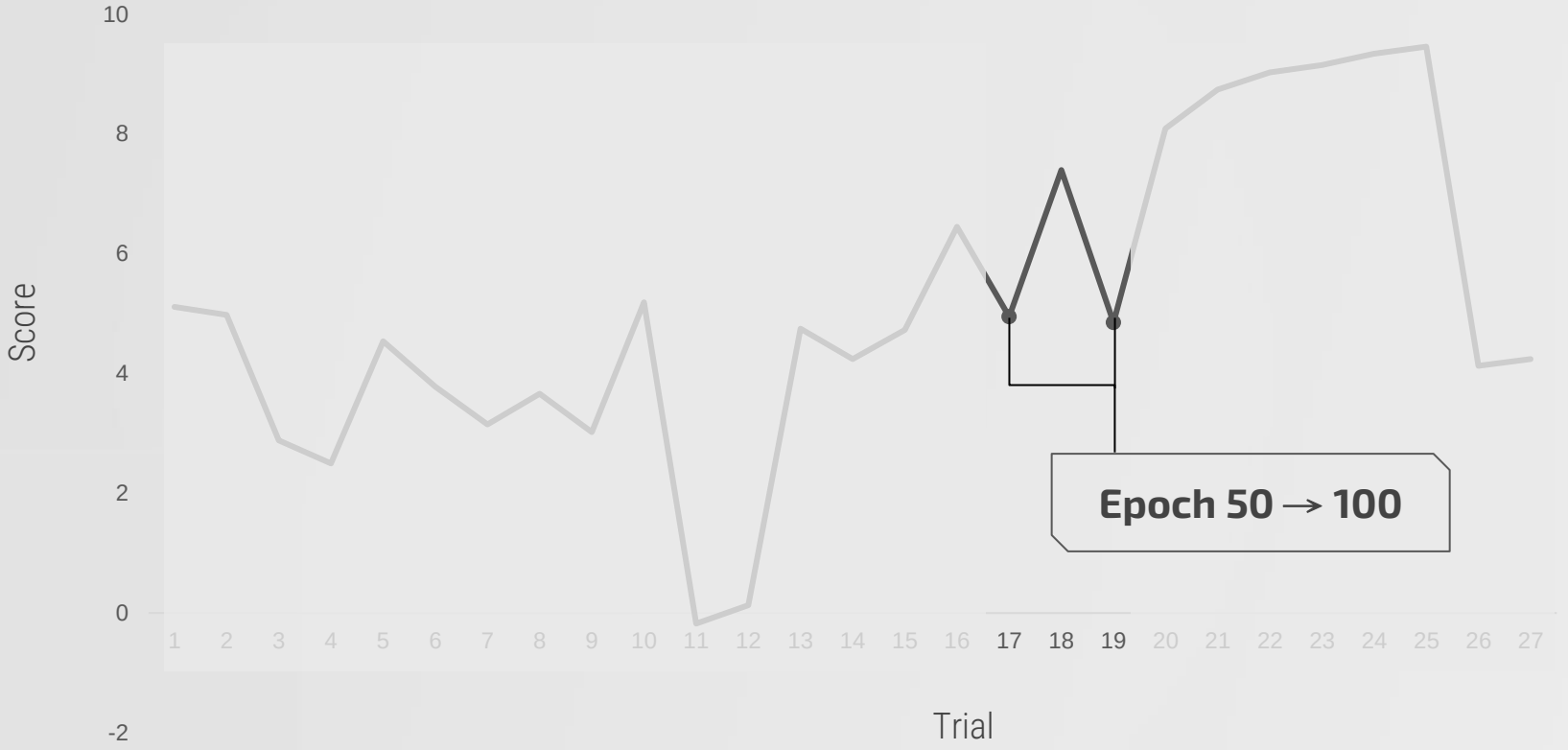
OUR JOURNEY TO SCORE THE BEST RESULT



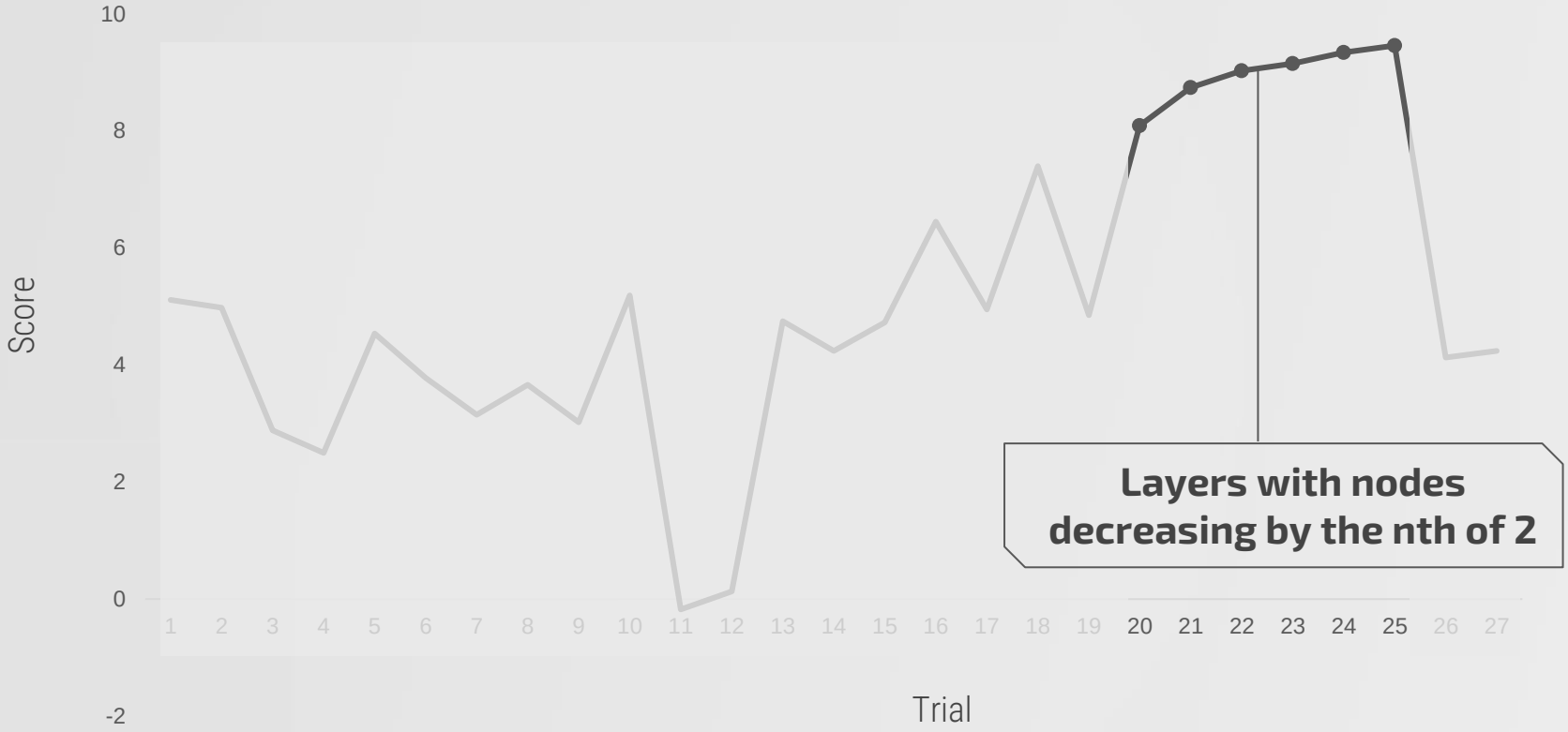
OUR JOURNEY TO SCORE THE BEST RESULT



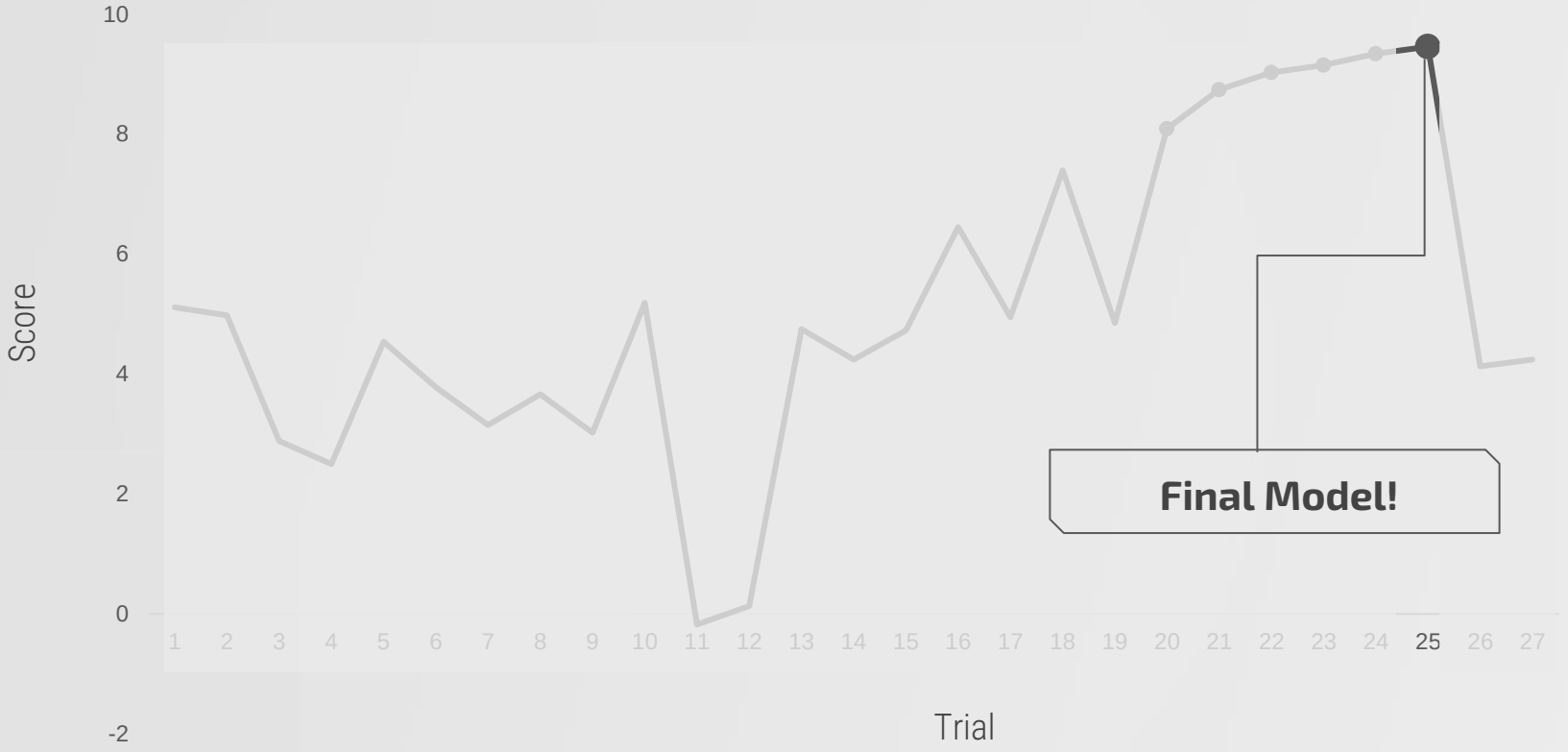
OUR JOURNEY TO SCORE THE BEST RESULT



OUR JOURNEY TO SCORE THE BEST RESULT



OUR JOURNEY TO SCORE THE BEST RESULT



FINAL MODEL

9.46

adamax

Optimizer

10

layers

nodes

512, 256, 128, 64, 32, 16, 8, 4, 2,1

5

Patience

Batch size

256

50

Epochs

04

Model 2

Problem 1

Given the 58-year portfolio data, what is the highest sharpe ratio we can achieve?

Problem 2

What is the best performance (a.k.a highest R-square) we can achieve with the market return and predictors dataset?

STRATEGY

adam, RMSprop — Optimizer, Learning Rate

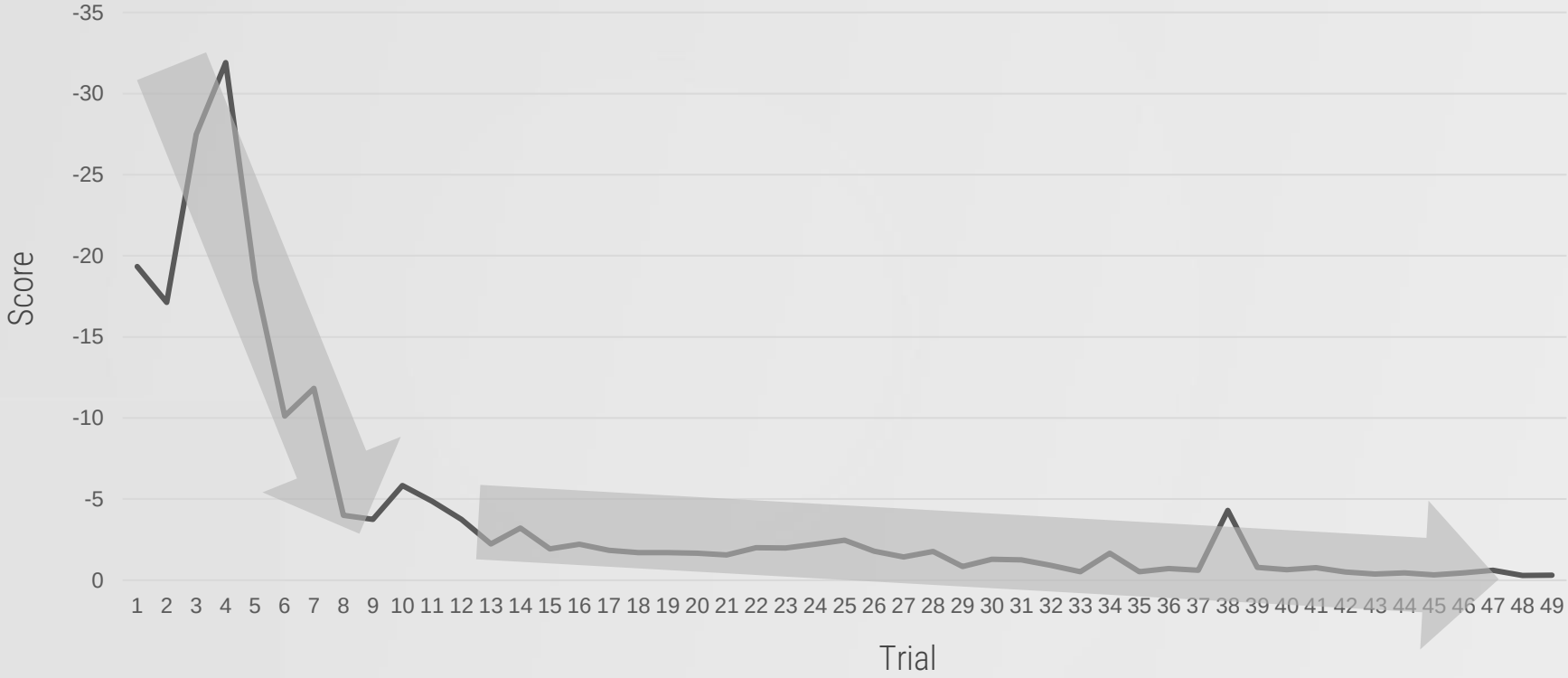
 # nodes
 # layers — Model structure

LayerNormalization()
BatchNormalization() — Randomize

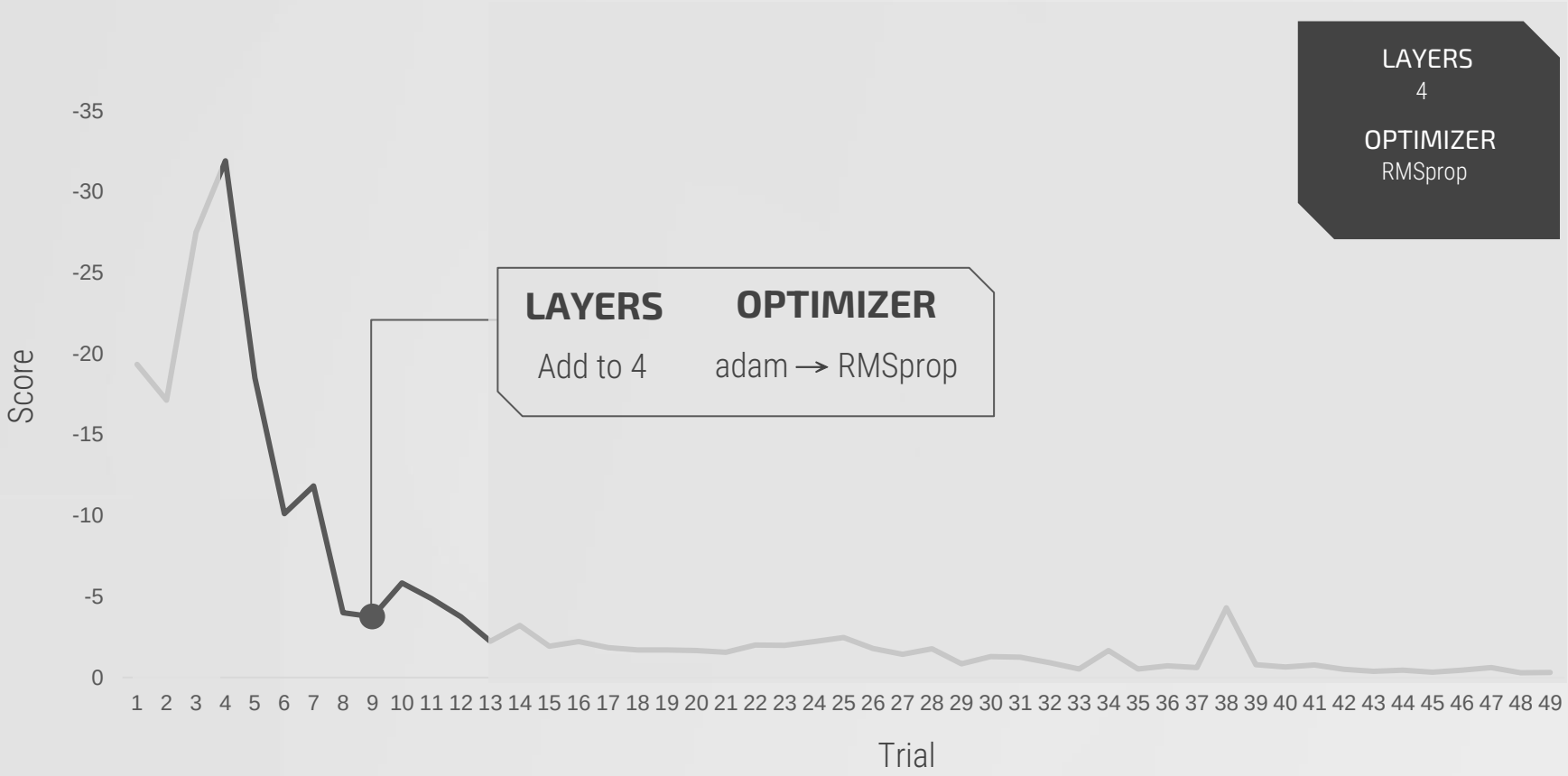
 # patience — Early stopping

Epoch, Batch Size

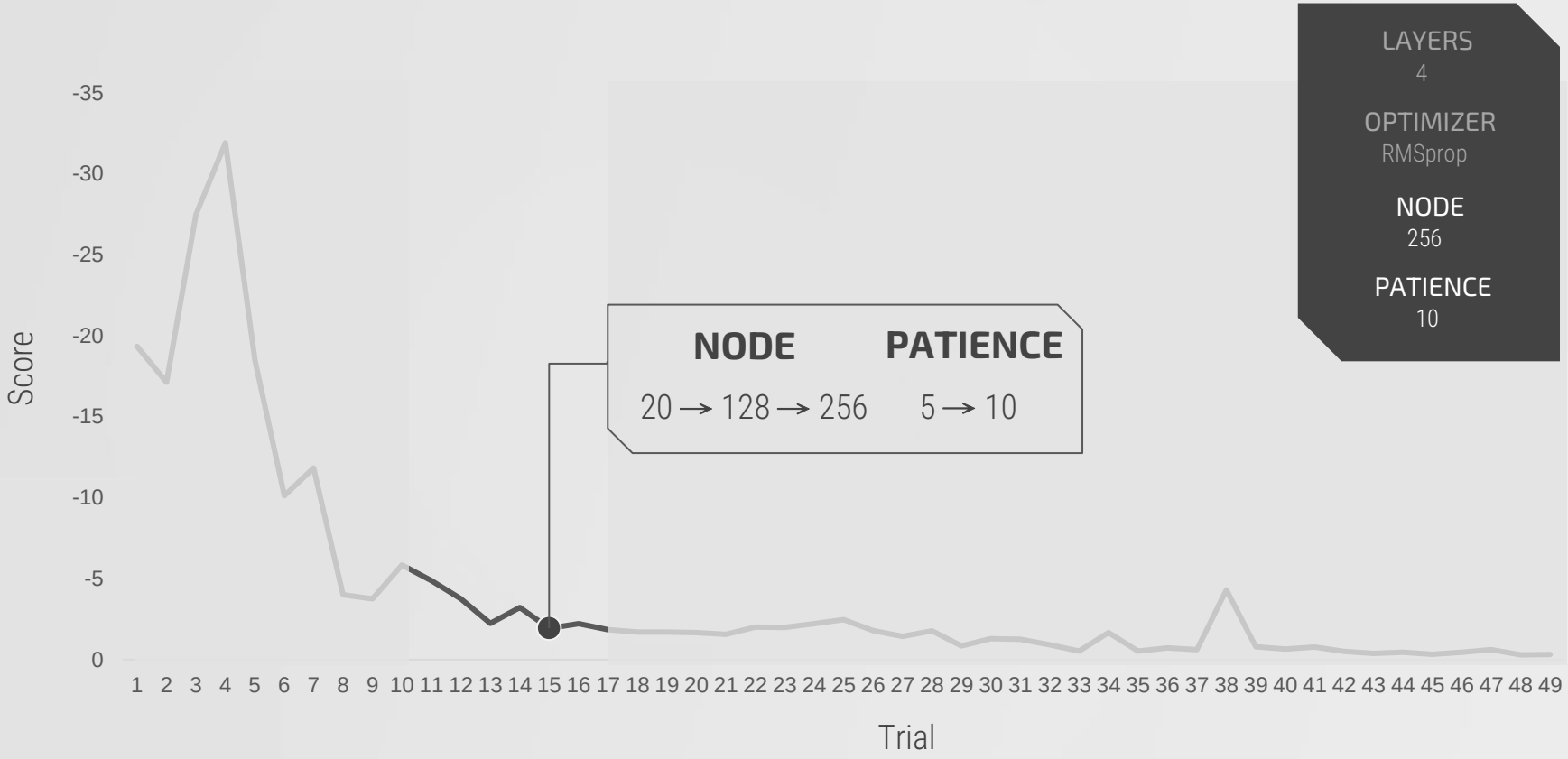
OUR JOURNEY TO SCORE THE BEST RESULT



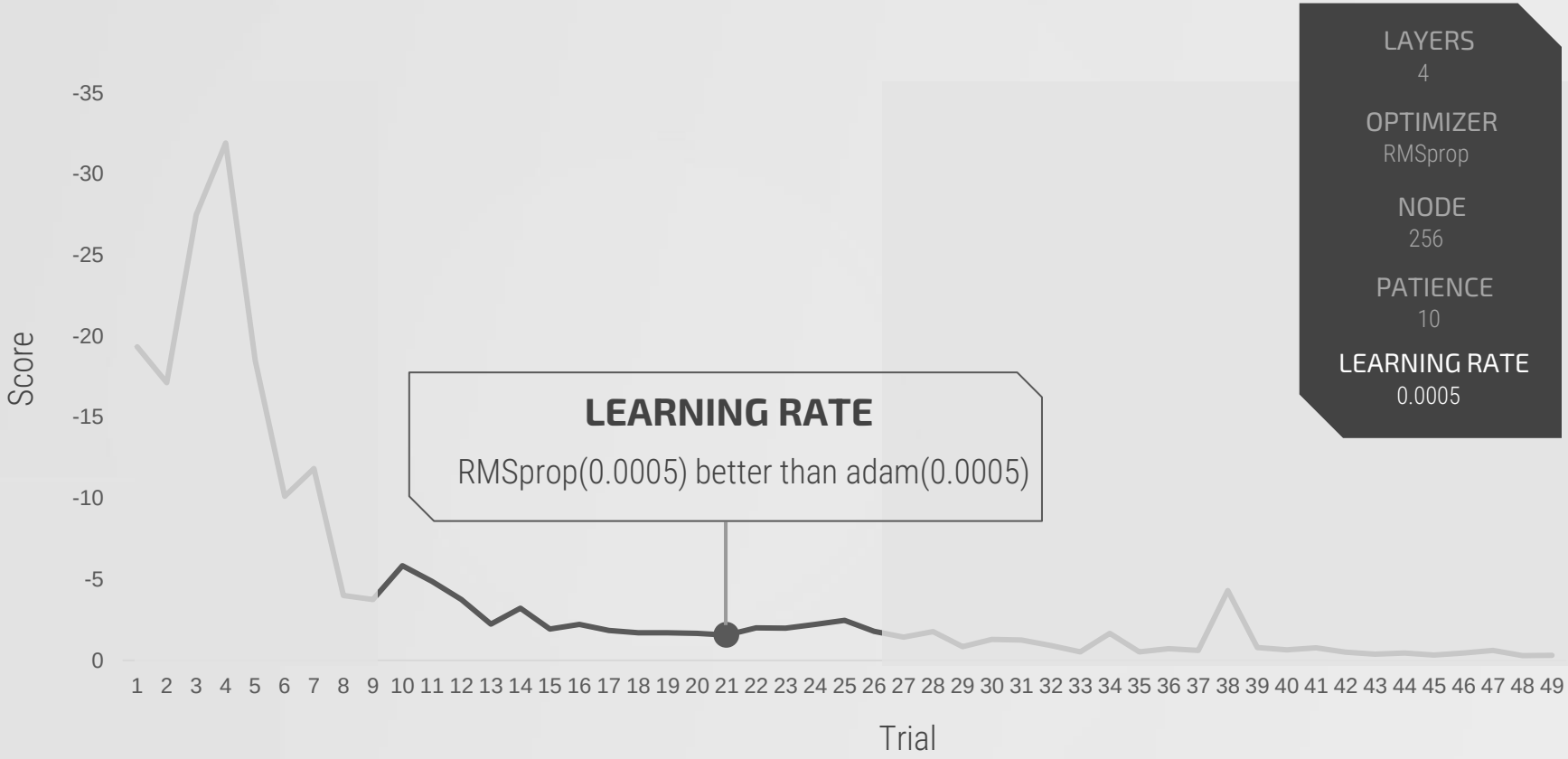
OUR JOURNEY TO SCORE THE BEST RESULT



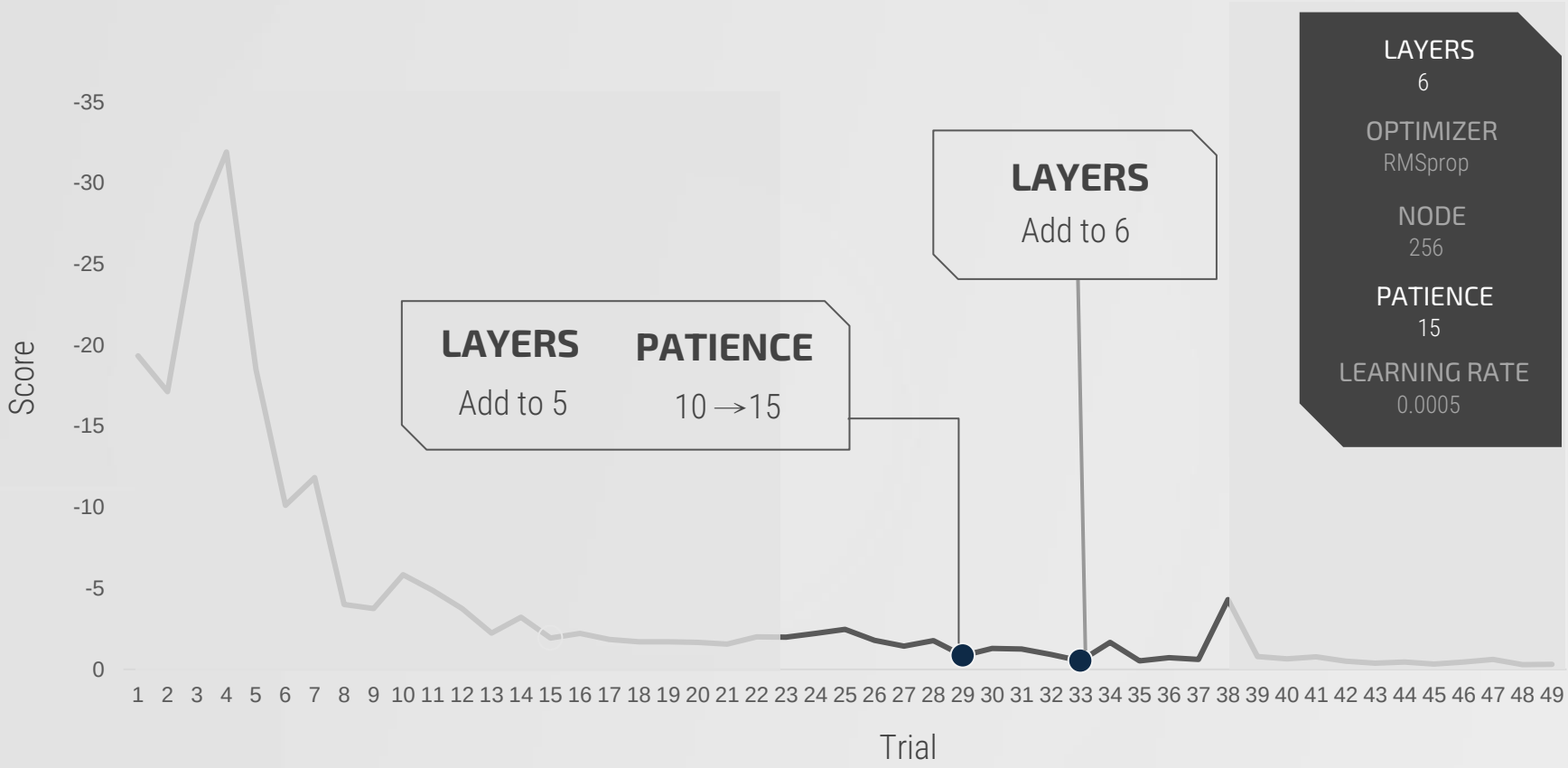
OUR JOURNEY TO SCORE THE BEST RESULT



OUR JOURNEY TO SCORE THE BEST RESULT

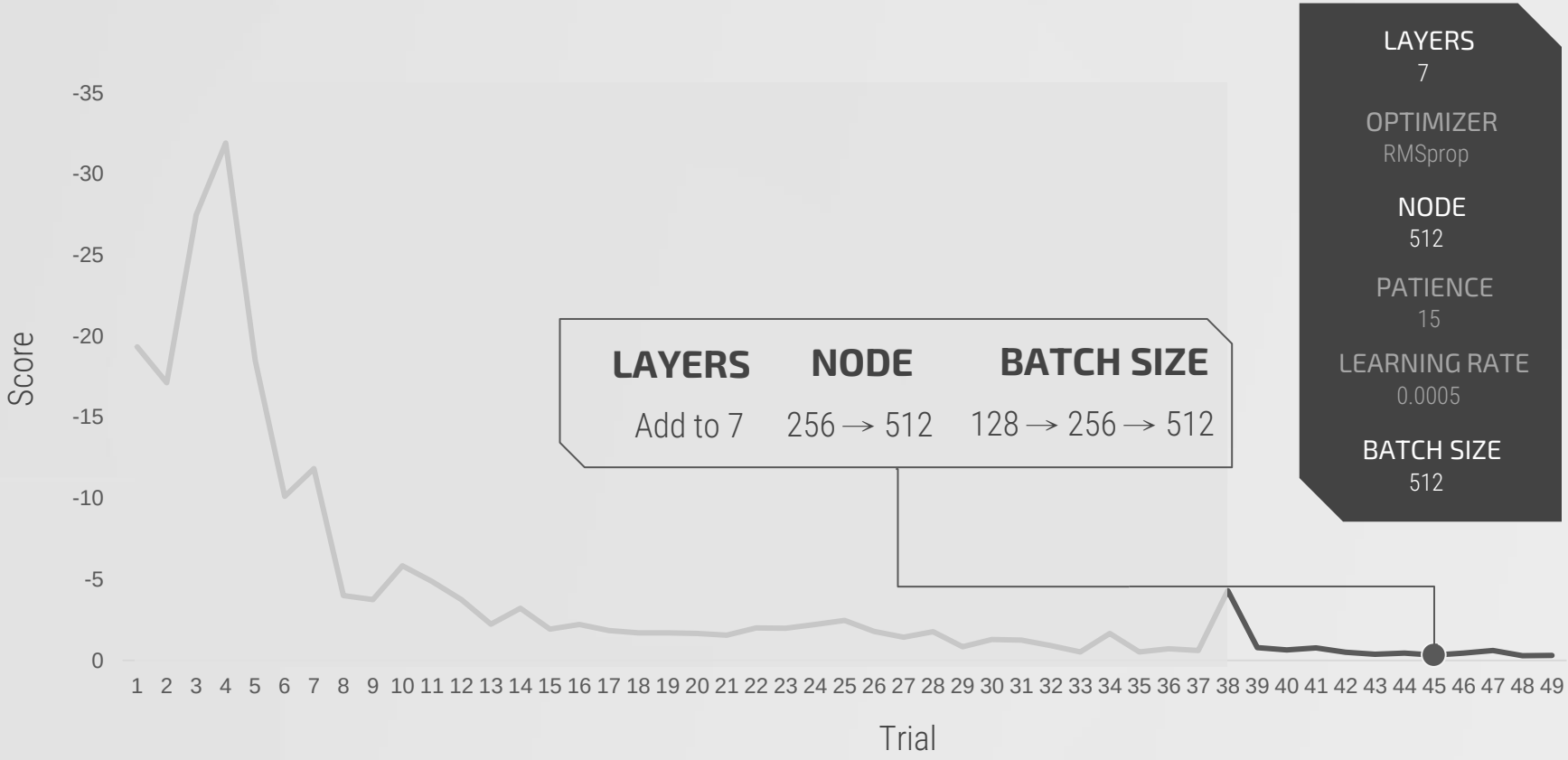


OUR JOURNEY TO SCORE THE BEST RESULT

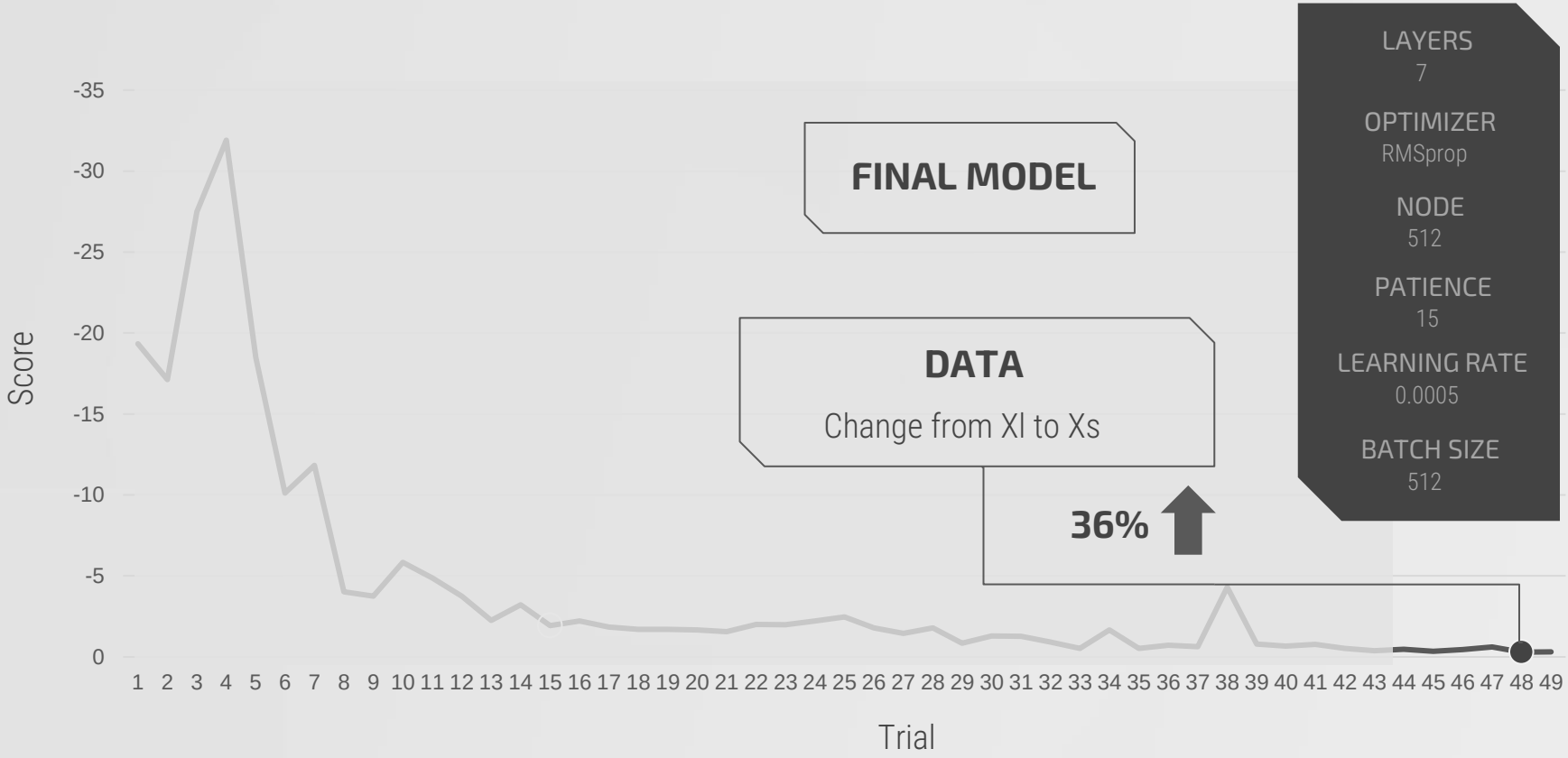


OUR JOURNEY TO SCORE THE BEST RESULT

OUR JOURNEY TO SCORE THE BEST RESULT

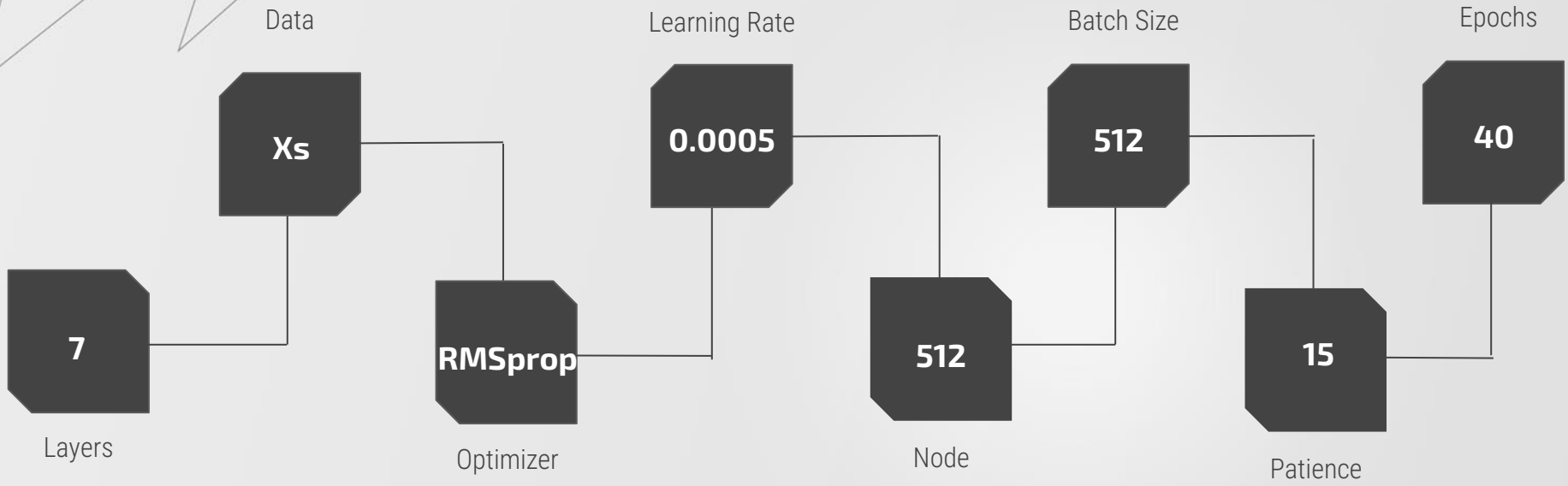


OUR JOURNEY TO SCORE THE BEST RESULT



FINAL MODEL AND RESULT

-0.287



05

Lessons Learned

FINDINGS

Best performance with ‘adam’ when in a simple-layer model, but ‘adamax’ and ‘RMSprop’ outperforms in a more complicated model

Model 1

- Larger batch size seems to perform better
- Consistency in # nodes is good (opposite case in model 1)
- Consistency in # nodes and batch size is good

Model 2

LESSONS LEARNED

Different Combinations

step-by-step
Organized way

Time Management

Running Time

THANK YOU