



**UNDERGRADUATE THESIS**

**COMPARISON OF XGBOOST, LSTM, AND  
NEURAL PROPHET MODELS FOR RED  
CAYENNE PEPPER PRICE PREDICTION IN  
EAST JAVA**

**HAFID ALFA ANAMSYAH**  
NPM 20081010189

**THESIS ADVISORS**

Dr. I Gede Susrama Mas Diyasa, S.T., M.T., IPU  
Andreas Nugroho Sihananto, S.Kom., M.Kom.

**MINISTRY OF HIGHER EDUCATION, SCIENCE, AND TECHNOLOGY  
UNIVERSITAS PEMBANGUNAN NASIONAL VETERAN JAWA TIMUR  
FACULTY OF COMPUTER SCIENCE  
INFORMATICS STUDY PROGRAM  
SURABAYA  
2026**

## APPROVAL SHEET

### COMPARISON OF XGBOOST, LSTM, AND NEURAL PROPHET MODELS FOR RED CAYENNE PEPPER PRICE PREDICTION IN EAST JAVA

By:  
HAFID ALFA ANAMSYAH  
NPM. 20081010189

Has been defended before, and accepted by, the Board of Assessors of the Thesis Examination of the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional Veteran Jawa Timur, on April 17, 2026:

Approved,

Dr. I Gede Susrama Mas Divasa, S.T., M.T., IPU  
NIP. 19700619 202121 1 009

  
.....

(Advisor I)

Andreas Nugroho Sihananto, S.Kom., M.Kom.  
NIP. 19900412 202406 1 003

  
.....

(Advisor II)

Fetty Tri Anggraeny, S.Kom. M.Kom.  
NIP. 19820211 202121 2 005

  
.....

(Head Assessor)

Budi Mukhamad Mulyo, S.Kom., M.T.  
NIP. 19891118 202406 1 003

  
.....

(Assessor I)

Acknowledge by,

Dean of the Faculty of Computer Science



Prof. Dr. Ir. Novirina Hendrasarie, MT.

NIP. 19681126 199403 2 001

**APPROVAL SHEET**

**COMPARISON OF XGBOOST, LSTM, AND NEURAL PROPHEET  
MODELS FOR RED CAYENNE PEPPER PRICE PREDICTION IN EAST  
JAVA**

By:  
**HAFID ALFA ANAMSYAH**  
NPM. 20081010189

Approved to proceed to the Thesis Examination



Approved by,

**Coordinator of Informatics Study Program  
Faculty of Computer Science**

**Dr. Intan Yuniar Purbasari, S.Kom. MSc.**

**NIP. 19800602 202521 2 029**

## STATEMENT OF ORIGINALITY

I am the undersigned:

Student Name : Hafid Alfa Anamsyah  
NPM : 20081010189  
Degree Program : Bachelor (S1)  
Study Program : Informatics  
Faculty : Faculty of Computer Science

Hereby declares that this undergraduate thesis contains no part of any other scientific work that has been submitted to obtain an academic degree at any higher education institution. Furthermore, it does not contain any work or opinions previously written or published by others, except for those which are explicitly cited in this thesis and listed completely in references.

And I declare that this scientific document is free from elements of plagiarism. If in the future indications of plagiarism are found in this Thesis, I am willing to accept sanctions in accordance with the applicable laws and regulations.

Thus, I made this statement without any coercion from anyone and to be used as it should.



Surabaya, April 17, 2026  
Declarant,



HAFID ALFA ANAMSYAH  
NPM. 20081010189

## ABSTRACT

Student Name / NPM: Hafid Alfa Anamsyah/20081010189  
Thesis Title: Comparison Of Xgboost, Lstm, And Neural Prophet Models For Red Cayenne Pepper Price Prediction In East Java  
Supervisor: 1. Dr. I Gede Susrama Mas Diyasa, S.T., M.T., IPU  
2. Andreas Nugroho Sihananto, S.Kom., M.Kom.

The price of red cayenne pepper in Indonesia, especially in East Java Province, often experiences significant fluctuations that have an impact on food inflation and the economic stability of the community. Therefore, accurate price predictions are needed to help decision-making in the management of the food supply chain. This study aims to compare the performance of three machine learning and deep learning models, namely XGBoost, LSTM, and Neural Prophet, in predicting the price of red cayenne pepper based on historical data from September 2024 to August 2025 obtained from the official website of the Siskaperbapo of the East Java Province Department of Industry and Trade (DISPERINDAG). The analysis was carried out using a quantitative approach using time series forecasting data, with performance evaluation through RMSE, MAE, and MAPE metrics. The results showed that the XGBoost model provided the best accuracy with RMSE values of 0.52, MAE 0.40, and MAPE of 1.42%, compared to XGBoost and Neural Prophet. Based on the overall results of the analysis, it can be concluded that the model selection, the length of the data, and the proportion of data sharing have a significant effect on the accuracy of price predictions, where XGBoost is the best model because it produces the most accurate and stable predictions, and the use of longer datasets and larger training data tends to improve model performance. This research contributes to the development of artificial intelligence-based food price prediction as a basis for price stabilization policy decision-making in the agricultural sector.

**Keywords:** Price prediction, Red cayenne pepper, XGBoost, LSTM, Neural Prophet, Time series forecasting

## ACKNOWLEDGMENTS

Praise be to Allah SWT for all His graces, guidance, and gifts to the author so that the thesis proposal with the title "**Comparison Of Xgboost, Lstm, And Neural Prophet Models For Red Cayenne Pepper Price Prediction In East Java**" can be completed properly.

The author would like to thank Mr. Dr. I Gede Susrama Mas Diyasa, S.T., M.T., IPU as Advisor I and Mr. Andreas Nugroho Sihananto, S.Kom., M.Kom. as Advisor II who are willing to take the time to provide guidance, advice and motivation to the author. In addition, during the preparation of thesis proposals, the author also received a lot of help from various parties. For this the author would like to thank the:

1. Mrs. Prof. Dr. Ir. Novirina Hendrasarie, M.T. as the Dean of the Faculty of Computer Science, Universitas Pembangunan Nasional Veteran Jawa Timur.
2. Mrs. Dr. Intan Yuniar Purbasari, S.Kom. MSc. as the Coordinator of the Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional Veteran Jawa Timur.
3. Lecturers of the Informatics Study Program at the Universitas Pembangunan Nasional Veteran Jawa Timur for their guidance during the author's education.
4. My beloved mother, who has always played an important role in the writer's journey, has always provided support, both material and mental. It is always a place to return when the writer feels tired. Always present with his best prayers, being a source of strength that never goes out, the writer can survive until now.
5. My beloved father, who taught to be a responsible person, worked hard, and did not give up easily. His advice and example are an important foundation for the writer in undergoing every process with determination.

6. My younger brother and family members who I cannot mention one by one, who have accompanied me in my life and accompanied me as I grow up to now.

The author realizes that in the preparation of the following thesis there are many shortcomings. For this reason, constructive criticism and suggestions from all parties are highly expected for the perfection of writing the following thesis. Finally, with all the limitations that the author has, hopefully the following report can be useful for all parties in general and the author in particular.

Surabaya, April 17, 2026

Author

## TABLE OF CONTENTS

<b><u>COVER PAGE</u></b> .....	<b>i</b>
<b><u>APPROVAL SHEET</u></b> .....	<b>ii</b>
<b><u>APPROVAL SHEET</u></b> .....	<b>iii</b>
<b><u>STATEMENT OF ORIGINALITY</u></b> .....	<b>iv</b>
<b><u>ABSTRACT</u></b> .....	<b>v</b>
<b><u>ACKNOWLEDGMENTS</u></b> .....	<b>vi</b>
<b><u>TABLE OF CONTENTS</u></b> .....	<b>viii</b>
<b><u>LIST OF FIGURES</u></b> .....	<b>x</b>
<b><u>LIST OF TABLES</u></b> .....	<b>xiii</b>
<b><u>CHAPTER 1 INTRODUCTION</u></b> .....	<b>1</b>
1.1. <u>Background</u> .....	1
1.2. <u>Problem Formulation</u> .....	4
1.3. <u>Research Objectives</u> .....	4
1.4 <u>Research Benefits</u> .....	4
1.5 <u>Research Limitations</u> .....	5
<b><u>CHAPTER II LITERATURE REVIEW</u></b> .....	<b>7</b>
2.1. <u>Previous Research</u> .....	7
2.2. <u>Theoretical Basis</u> .....	8
2.2.1. <u>Concept of Commodity Price Forecasting</u> .....	8
2.2.2. <u>Time Series Forecasting</u> .....	9
2.2.3. <u>XGBoost (Extreme Gradient Boosting)</u> .....	10
2.2.4. <u>LSTM (Long Short-Term Memory)</u> .....	11
2.2.5. <u>Neural Prophet</u> .....	11
2.2.6. <u>Prediction Model Evaluation Metrics</u> .....	12
<b><u>CHAPTER III RESEARCH METHODS</u></b> .....	<b>15</b>
3.1. <u>Type of Research</u> .....	15
3.2. <u>Data Collection Techniques</u> .....	15
3.3. <u>Flowchart</u> .....	16

3.3.1.	<u>Research Flowchart</u> .....	16
3.3.2.	<u>XGBoost Flowchart</u> .....	17
3.3.3.	<u>LSTM Flowchart</u> .....	19
3.3.4.	<u>Neural Prophet Flowchart</u> .....	20
3.4.	<u>Testing Scenario</u> .....	22
3.5.	<u>Pseudocode</u> .....	23
3.5.1.	<u>Research Pseudocode</u> .....	23
3.5.2.	<u>XGBoost Pseudocode</u> .....	24
3.5.3.	<u>LSTM Pseudocode</u> .....	25
3.5.4.	<u>Neural Prophet Pseudocode</u> .....	26
	<b><u>CHAPTER IV RESEARCH RESULTS</u></b> .....	<b>28</b>
4.1.	<u>Data Overview</u> .....	28
4.2.	<u>Model Implementation Results</u> .....	31
4.2.1.	<u>XGBoost Model Results</u> .....	31
4.2.2.	<u>LSTM Model Results</u> .....	38
4.2.3.	<u>Neural Prophet Model Results</u> .....	45
4.3.	<u>Model Performance Comparison</u> .....	51
4.4.	<u>Best Model</u> .....	53
4.5.	<u>Discussion of Research Results</u> .....	53
4.6.	<u>Data Prediction Based on the Best Model</u> .....	54
	<b><u>CHAPTER V CLOSING</u></b> .....	<b>58</b>
5.1.	<u>Conclusion</u> .....	58
5.2.	<u>Recommendations</u> .....	59
5.2.1.	<u>Practical Recommendations</u> .....	59
5.2.2.	<u>Academic Recommendations</u> .....	60
	<b><u>BIBLIOGRAPHY</u></b> .....	<b>61</b>

## LIST OF FIGURES

<b><u>Figure 3.1</u></b> Research Flowchart .....	16
<b><u>Figure 3.2</u></b> XGBoost Flowchart .....	18
<b><u>Figure 3.3</u></b> LSTM Flowchart.....	19
<b><u>Figure 3.4</u></b> Neural Prophet Flowchart .....	21
<b><u>Figure 4.1</u></b> Red cayenne pepper prices in East Java, June-August 2025 (3 Months). .....	28
<b><u>Figure 4.2</u></b> Red cayenne pepper prices in East Java, March-August 2025 (6 Months) .....	29
<b><u>Figure 4.3</u></b> Red cayenne pepper prices in East Java, September 2024-August 2025 (1 Year).....	29
<b><u>Figure 4.4</u></b> Red Cayenne Pepper Price Trends in East Java, June-August 2025 (3 Months).....	30
<b><u>Figure 4.5</u></b> Red Cayenne Pepper Price Trends in East Java, March-August 2025 (6 Months).....	30
<b><u>Figure 4.6</u></b> Red Cayenne Pepper Price Trends in East Java, September 2024-August 2025 (1 Year).....	31
<b><u>Figure 4.7</u></b> Implementation of the XGBoost model for red chili prices in East Java from June to August 2025 (3 months) with a 60:40 dataset split.....	32
<b><u>Figure 4.8</u></b> Implementation of the XGBoost model for red chili prices in East Java from June to August 2025 (3 months) with a 70:30 dataset split.....	32
<b><u>Figure 4.9</u></b> Implementation of the XGBoost model for red chili prices in East Java from June to August 2025 (3 months) with a 80:20 dataset split.....	33
<b><u>Figure 4.10</u></b> Implementation of the XGBoost model for red chili prices in East Java from March to August 2025 (6 months) with a 60:40 dataset split.....	34
<b><u>Figure 4.11</u></b> Implementation of the XGBoost model for red chili prices in East Java from March to August 2025 (6 months) with a 70:30 dataset split.....	34
<b><u>Figure 4.12</u></b> Implementation of the XGBoost model for red chili prices in East Java from March to August 2025 (6 months) with a 80:20 dataset split.....	35

<b><u>Figure 4.13</u></b> Implementation of the XGBoost model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 60:40 dataset split.....	<b>36</b>
<b><u>Figure 4.14</u></b> Implementation of the XGBoost model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 70:30 dataset split.....	<b>36</b>
<b><u>Figure 4.15</u></b> Implementation of the XGBoost model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 80:20 dataset split.....	<b>37</b>
<b><u>Figure 4.16</u></b> Implementation of the LSTM model for red chili prices in East Java from June to August 2025 (3 months) with a 60:40 dataset split.....	<b>38</b>
<b><u>Figure 4.17</u></b> Implementation of the LSTM model for red chili prices in East Java from June to August 2025 (3 months) with a 70:30 dataset split.....	<b>39</b>
<b><u>Figure 4.18</u></b> Implementation of the LSTM model for red chili prices in East Java from June to August 2025 (3 months) with a 80:20 dataset split.....	<b>40</b>
<b><u>Figure 4.19</u></b> Implementation of the LSTM model for red chili prices in East Java from March to August 2025 (6 months) with a 60:40 dataset split .....	<b>40</b>
<b><u>Figure 4.20</u></b> Implementation of the LSTM model for red chili prices in East Java from March to August 2025 (6 months) with a 70:30 dataset split .....	<b>41</b>
<b><u>Figure 4.21</u></b> Implementation of the LSTM model for red chili prices in East Java from March to August 2025 (6 months) with a 80:20 dataset split .....	<b>42</b>
<b><u>Figure 4.22</u></b> Implementation of the LSTM model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 60:40 dataset split.....	<b>42</b>
<b><u>Figure 4.23</u></b> Implementation of the LSTM model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 70:30 dataset split.....	<b>43</b>
<b><u>Figure 4.24</u></b> Implementation of the LSTM model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 80:20 dataset split.....	<b>44</b>
<b><u>Figure 4.25</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from June to August 2025 (3 months) with a 60:40 dataset split. ....	<b>45</b>
<b><u>Figure 4.26</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from June to August 2025 (3 months) with a 70:30 dataset split .....	<b>46</b>
<b><u>Figure 4.27</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from June to August 2025 (3 months) with a 80:20 dataset split .....	<b>46</b>

<b><u>Figure 4.28</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from March to August 2025 (6 months) with a 60:40 dataset split.....	47
<b><u>Figure 4.29</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from March to August 2025 (6 months) with a 70:30 dataset split.....	48
<b><u>Figure 4.30</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from March to August 2025 (6 months) with a 80:20 dataset split.....	48
<b><u>Figure 4.31</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 60:40 dataset split....	49
<b><u>Figure 4.32</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 70:30 dataset split....	50
<b><u>Figure 4.33</u></b> Implementation of the Neural Prophet model for red chili prices in East Java from September 2024 to August 2025 (1 year) with a 80:20 dataset split....	50
<b><u>Figure 4.34</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (3 Months - 60:40 - XGBoost).....	54
<b><u>Figure 4.35</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (3 Months - 70:30 - XGBoost).....	55
<b><u>Figure 4.36</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (3 Months - 80:20 - LSTM).....	55
<b><u>Figure 4.37</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (6 Months - 60:40 - XGBoost).....	55
<b><u>Figure 4.38</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (6 Months - 70:30 - XGBoost).....	56
<b><u>Figure 4.39</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (6 Months - 80:20 - XGBoost).....	56
<b><u>Figure 4.40</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (1 Year - 60:40 - XGBoost).....	56
<b><u>Figure 4.41</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (1 Year - 70:30 - XGBoost).....	57
<b><u>Figure 4.42</u></b> Red Chili Pepper Price Forecast for the Next 6 Months (1 Year - 80:20 - XGBoost).....	57

## LIST OF TABLES

<b>Table 3.1</b> Testing Scenario .....	<b>22</b>
<b>Table 3.2</b> Research Pseudocode .....	<b>23</b>
<b>Table 3.3</b> XGBoost Pseudocode.....	<b>24</b>
<b>Table 3.4</b> LSTM Pseudocode .....	<b>25</b>
<b>Table 3.5</b> Neural Prophet Pseudocode .....	<b>26</b>
<b>Table 4.1</b> Results of the XGBoost 3-Month 60:40 Model Evaluation. ....	<b>32</b>
<b>Table 4.2</b> Results of the XGBoost 3-Month 70:30 Model Evaluation.....	<b>33</b>
<b>Table 4.3</b> Results of the XGBoost 3-Month 80:20 Model Evaluation.....	<b>33</b>
<b>Table 4.4</b> Results of the XGBoost 6-Month 60:40 Model Evaluation.....	<b>34</b>
<b>Table 4.5</b> Results of the XGBoost 6-Month 70:30 Model Evaluation.....	<b>35</b>
<b>Table 4.6</b> Results of the XGBoost 6-Month 80:20 Model Evaluation.....	<b>35</b>
<b>Table 4.7</b> Results of the XGBoost 1-Year 60:40 Model Evaluation.....	<b>36</b>
<b>Table 4.8</b> Results of the XGBoost 1-Year 70:30 Model Evaluation.....	<b>37</b>
<b>Table 4.9</b> Results of the XGBoost 1-Year 80:20 Model Evaluation.....	<b>37</b>
<b>Table 4.10</b> Results of the XGBoost 3-Month 60:40 Model Evaluation.....	<b>38</b>
<b>Table 4.11</b> Results of the XGBoost 3-Month 70:30 Model Evaluation.....	<b>39</b>
<b>Table 4.12</b> Results of the XGBoost 3-Month 80:20 Model Evaluation.....	<b>40</b>
<b>Table 4.13</b> Results of the XGBoost 6-Month 60:40 Model Evaluation.....	<b>41</b>
<b>Table 4.14</b> Results of the XGBoost 6-Month 70:30 Model Evaluation.....	<b>41</b>
<b>Table 4.15</b> Results of the XGBoost 6-Month 80:20 Model Evaluation.....	<b>42</b>
<b>Table 4.16</b> Results of the XGBoost 1-Year 60:40 Model Evaluation.....	<b>43</b>
<b>Table 4.17</b> Results of the XGBoost 1-Year 70:30 Model Evaluation.....	<b>43</b>
<b>Table 4.18</b> Results of the XGBoost 1-Year 80:20 Model Evaluation.....	<b>44</b>
<b>Table 4.19</b> Results of the XGBoost 3-Month 60:40 Model Evaluation.....	<b>45</b>
<b>Table 4.20</b> Results of the XGBoost 3-Month 70:30 Model Evaluation.....	<b>46</b>
<b>Table 4.21</b> Results of the XGBoost 3-Month 80:20 Model Evaluation.....	<b>47</b>
<b>Table 4.22</b> Results of the XGBoost 6-Month 60:40 Model Evaluation.....	<b>47</b>
<b>Table 4.23</b> Results of the XGBoost 6-Month 70:30 Model Evaluation.....	<b>48</b>
<b>Table 4.24</b> Results of the XGBoost 6-Month 80:20 Model Evaluation.....	<b>49</b>

<b>Table 4.25</b> Results of the XGBoost 1-Year 60:40 Model Evaluation .....	<b>49</b>
<b>Table 4.26</b> Results of the XGBoost 1-Year 70:30 Model Evaluation .....	<b>50</b>
<b>Table 4.27</b> Results of the XGBoost 1-Year 80:20 Model Evaluation .....	<b>51</b>
<b>Table 4.28</b> Model Performance Comparison .....	<b>51</b>