UNDERGRADUATE THESIS

FORECASTING GOOGLE SEARCH TRENDS FOR THE KEYWORD "KOPI KENANGAN" USING SINGULAR SPECTRUM ANALYSIS (SSA)

ARYA FADHILAH DANISWARA
NPM 19081010187

THESIS ADVISORS
Fetty Tri Anggraeny, S.Kom. M.Kom
M. Muharrom Al Haromainy, 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

FORECASTING GOOGLE SEARCH TRENDS FOR THE KEYWORD "KOPI KENANGAN" USING SINGULAR SPECTRUM ANALYSIS (SSA)

By:

ARYA FADHILAH DANISWARA

NPM. 19081010187

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 June 11, 2026:

Approved,

Fetty Tri Anggraeny, S.Kom. M.Kom **NIP. 19820211 202121 2 005**	.....	**(Advisor I)**
M. Muharrom Al Haromainy, S.Kom., M.Kom **NIP. 19950601 202203 1 006**	.....	**(Advisor II)**
Dr. Rizky Parlika, S.Kom, M.Kom. **NIP. 19840518 2021211 003**	.....	**(Head Assessor)**
Achmad Junaidi, S.Kom, M.Kom **NIP. 197811102025211048**	.....	**(Assessor I)**

Acknowledge by,
Dean of the Faculty of Computer Science

Prof. Dr. Ir. Novirina Hendrasarie, MT.
NIP. 19681126 199403 2 001

APPROVAL SHEET

FORECASTING GOOGLE SEARCH TRENDS FOR THE KEYWORD "KOPI KENANGAN" USING SINGULAR SPECTRUM ANALYSIS (SSA)

By:

ARYA FADHILAH DANISWARA

NPM. 19081010187

Approved to proceed to the Thesis Examination

Approved by,

Coordinator of Informatics Study Program
Faculty of Computer Science

Dr. Intan Yuniar Purbasari, S.Kom. M.Sc.
NIP. 19800602 2025212 029

STATEMENT OF ORIGINALITY

I am the undersigned:

Student Name	:	Arya Fadhilah Daniswara
NPM	:	19081010187
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, June 11, 2026
Declarant,

ARYA FADHILAH DANISWARA
NPM. 19081010187

ABSTRACT

Student Name / NPM:	Arya Fadhilah Daniswara/19081010187
Thesis Title:	Forecasting Google Search Trends for the Keyword "Kopi Kenangan" Using Singular Spectrum Analysis (SSA)
Supervisor:	1. Fetty Tri Anggraeny, S.Kom. M.Kom 2. M. Muharrom Al Haromainy, S.Kom., M.Kom

This study aims to forecast the Google Search Trends index for the keyword "Kopi Kenangan" in Indonesia using the Singular Spectrum Analysis (SSA) method. The data used in this study were obtained from Google Trends for the period of January 2021 to June 2026 and were processed into 66 monthly observations. Google Trends data in this study are positioned as a proxy or early indicator of public search interest, not as sales data, transaction volume, number of consumers, or actual demand. The research stages are organized using the Knowledge Discovery in Databases (KDD) framework as the data-processing workflow, while the main forecasting method is SSA. The data were divided chronologically using 70% training data and 30% testing data, resulting in 46 training observations and 20 testing observations. Parameter testing was conducted using window length L = 6 to L = 23 and the number of reconstruction components r = 2 to min(L - 1, 12). To address validation limitations, this study adds naive, seasonal naive, moving average, and simple ARIMA-grid baselines, as well as one-step walk-forward validation. Model performance was evaluated using MAE, MSE, RMSE, MAPE, sMAPE, and MASE. The results show that the best SSA configuration was obtained at L = 7 and r = 5, with MAE of 16.65, MSE of 430.96, RMSE of 20.76, MAPE of 24.74%, sMAPE of 27.78%, and MASE of 2.3101. The 12-month forecasting results for July 2026 to June 2027 indicate that the search index for "Kopi Kenangan" is projected to range from 95.57 to 100.00. Based on these results, SSA can be applied to forecast the Google Search Trends index; however, the forecasting results should be interpreted carefully as public search interest tendency, not as sales or actual demand prediction.

Keywords: Google Trends, Kopi Kenangan, public search interest, forecasting, Singular Spectrum Analysis.

ACKNOWLEDGEMENTS

Praise be to Allah SWT for all His graces, guidance, and gifts to the author so that the undergraduate thesis with the title "Forecasting Google Search Trends for the Keyword ‘Kopi Kenangan’ Using Singular Spectrum Analysis (SSA)" can be completed properly.

The author would like to thank Mrs. Fetty Tri Anggraeny, S.Kom. M.Kom as Advisor I and Mr. M. Muharrom Al Haromainy, S.Kom., M.Kom as Advisor II, who have taken the time to provide guidance, advice, and motivation to the author. In addition, during the preparation of this undergraduate thesis, the author also received much assistance from various parties. Therefore, the author would like to thank:

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. Fetty Tri Anggraeny, S.Kom. M.Kom. as the Coordinator of Informatics Study Program, Faculty of Computer Science, Universitas Pembangunan Nasional “Veteran” Jawa Timur.
3. Mrs. Fetty Tri Anggraeny, S.Kom. M.Kom. as Thesis Advisor I, who provided guidance, direction, and input during the thesis-writing process.
4. Mr. M. Muharrom Al Haromainy, S.Kom., M.Kom. as Thesis Advisor II, who provided suggestions, corrections, and support in improving the thesis.
5. The lecturers of the Informatics Study Program, who have provided knowledge and experience throughout the learning process.
6. Family, colleagues, and all parties who have provided assistance, prayers, and support to the author.

Surabaya, June 11, 2026

Author

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF NOTATIONS

Y : Time series containing all Google Trends index observations.

y_t : Observed value in period t.

N : Total number of observations in the time series.

L : Window length in SSA.

K : Number of columns in the trajectory matrix, calculated as N - L + 1.

X_i : The i-th column vector formed from the time series.

X : Trajectory matrix resulting from the embedding process.

S : Simple covariance matrix obtained from X X^T.

λ_i : The i-th eigenvalue of matrix S.

U_i : The i-th left eigenvector.

V_i : The i-th right singular vector.

d : Rank of the trajectory matrix.

I : Set of grouped component indices.

r : Number of reconstruction components used.

g_k : Value resulting from diagonal averaging at position k.

z_ij : Matrix element in row i and column j.

ŷ_t : Predicted or forecast value in period t.

a_i : Recurrent coefficient in the Linear Recurrent Formula.

e_t : Forecasting error in period t.

n : Number of data points used in the calculation of evaluation metrics.

MAE : Mean Absolute Error, the average absolute error.

MSE : Mean Squared Error, the average squared error.

RMSE : Root Mean Squared Error, the square root of MSE.

MAPE : Mean Absolute Percentage Error, absolute error in percentage form.

sMAPE : Symmetric Mean Absolute Percentage Error.

MASE : Mean Absolute Scaled Error.

SSA : Singular Spectrum Analysis.

KDD : Knowledge Discovery in Databases.

ARIMA : Autoregressive Integrated Moving Average.