Presented at the FIG e-Working Week 2021,
21-25 June 2021 in Virtually in the Netherlands

SMART SURVEYORS FOR LAND AND WATER MANAGEMENT
CHALLENGES IN A NEW REALITY

FIG NL THE NETHERLANDS

e WORKING WEEK 2021
20-25 JUNE

PAPER ID-11020

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" IMPLEMENTATION OF THE TENSORFLOW FRAMEWORK WITH API DETECTION OBJECT METHOD AND CONVOLUTIONAL NEURAL NETWORK ON LAND DOCUMENTS IN ELECTRONIC SERVICES AT THE MINISTRY OF AGRARIAN AFFAIRS AND SPATIAL PLANNING/ NATIONAL LAND AGENCY "

National Land College | Ministry Of Agrarian Affairs And Spatial Planning / National Land Agency

FIG e-Working Week 2021 - Netherland, 20– 25 June 2021

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SMART SURVEYORS FOR LAND AND WATER MANAGEMENT
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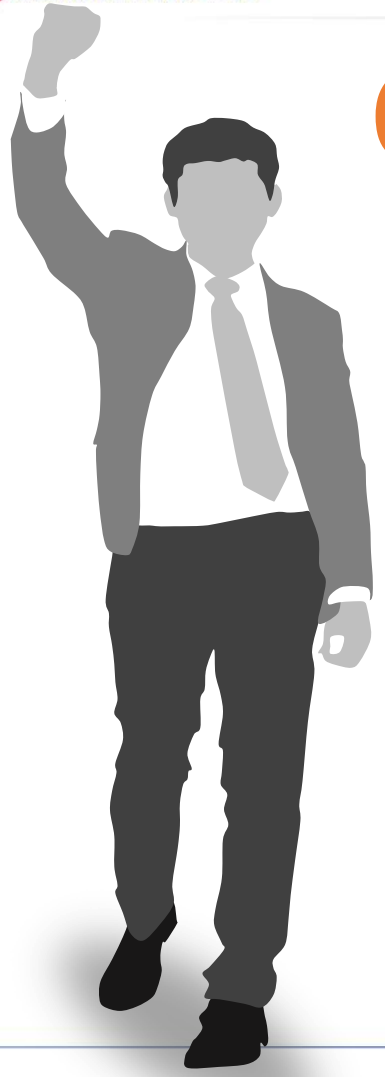

OUTLINE

01 The background and purpose of the study

Tells the existing problems, the use of virtual counters and the use of object detection technology using the Tensorflow framework and CNN algorithm

02 Method on the study

Describes the method used in this study. The researcher separates the test data and training data, then performs segmentation and normalization, labeling, classification, verification and validation of land documents in stages.

03 A Brief Literature Review

Explain theoretical studies based on expert opinion and sources from latest books, journals, proceedings and other sources

04 Result and discussion

- *Analysis of changes in measurement book and land book from 1960 to 2021;*
- *Test the accuracy of the CNN algorithm on land documents;*
- *Development of the Tensorflow Framework and the CNN Algorithm at the Future Virtual Land Counter*

05 Conclusion & Acknowledgement

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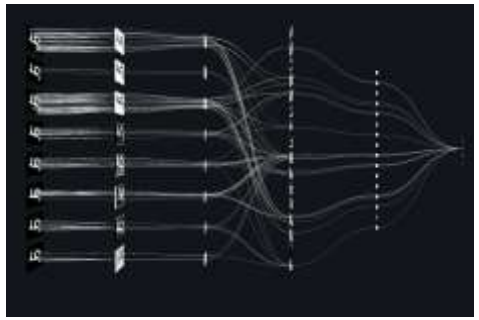
Ministry of Agraria Affairs and Spatial Planning /National Land Agency

(Djalil 2019)

The opportunities and challenges of the global covid-19 pandemic (Lumbanraja 2020)

Land parcel database → Valid land parcel database
To support and realize big data in agragian sector



Concolutional Neural Network (CNN)

Problem-solving solutions

AI and Deep Learning

Land documents are not fully digitalized and valid

Land book

+

Measurement book

Create an e-counter or virtual land counter using the tensorflow framework and the CNN algorithm → Transfer of media (analog document to electronic document)

Acceleration of validation of land documents and transfer of media is needed to realize full electronic services in 2025

This paper aims to analyze land document based on the type and year of changes, test the accuracy of object detection accuracy using the tensorflow framework object detection API and the CNN algorithm, and describe flowmap of land virtual counter

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METHOD

Separates the test data and training data

Image data is labeled according to the document number and year as well as the document page. Then the pre-processing of the image is carried out by means of binaryization and tresholding.

Performs segmentation and normalization

This is done to separate parts of the object and the background and to reduce the image resolution in order to improve recognition accuracy. The data is used as training data as TFRecord. Then do the labelmap configuration and pipeline training for neural network training.

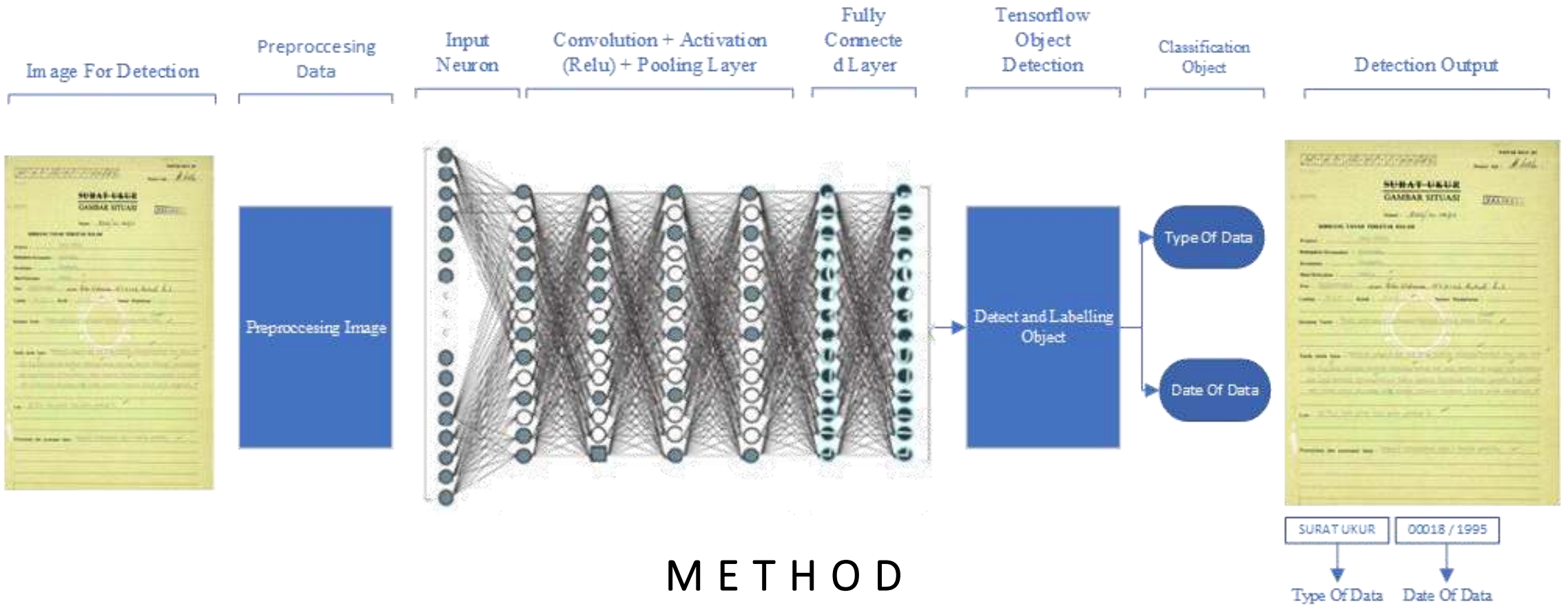
How researchers solve the problems

Verification and validation

The verification and validation process is carried out through machine learning automation using the framework tensorflow object detection API, so that the process of rejecting and accepting documents will be carried out automatically.

Labeling & classification

This analysis is carried out in the verification stage of land documents uploaded through virtual land counters



METHOD

Figure 1. Network Architecture
Source: Researchers' processed data 2021

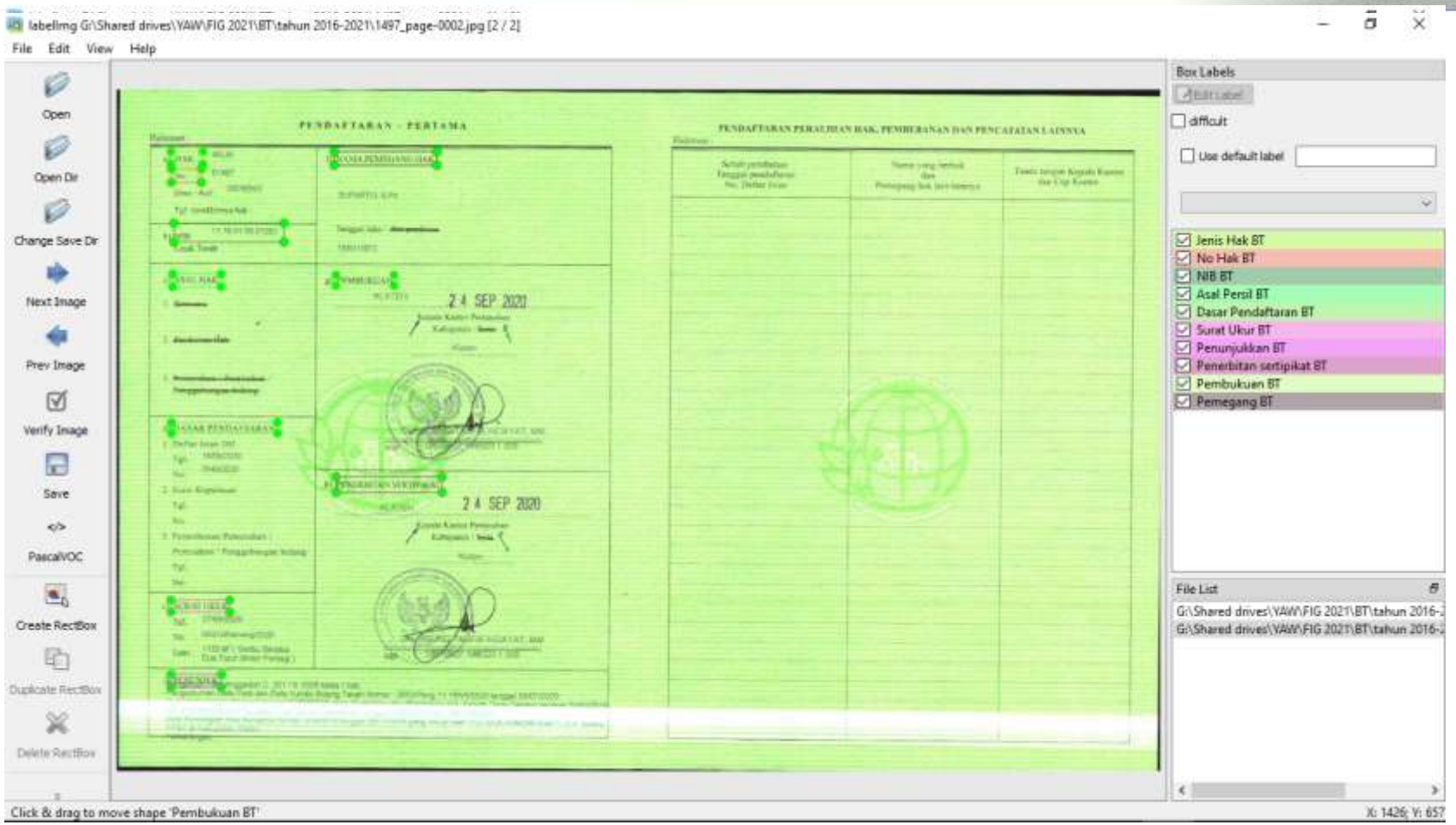


Figure 2. Labelling and classification
Source: Researchers' processed data 2021

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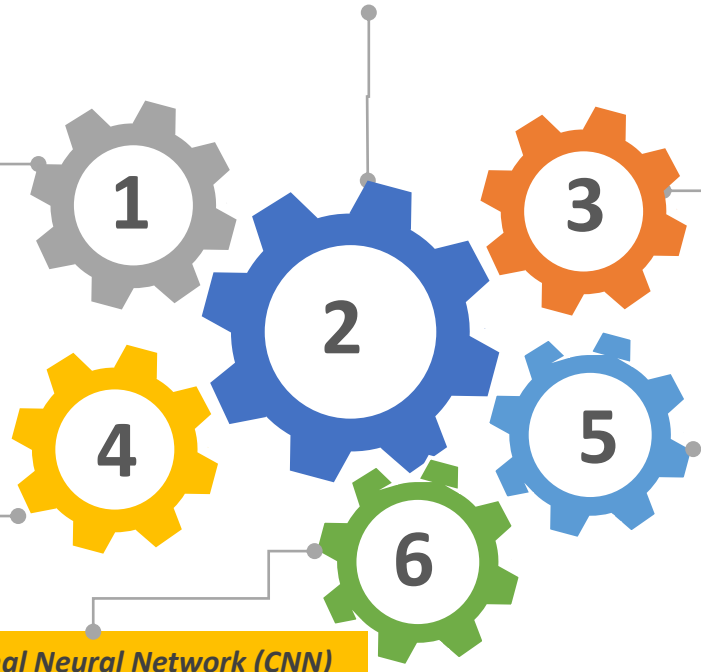
Land Book and Measurement Book

Land document used as the object of research are: measurement book and land book.

Implementation of Integrated Electronic Systems in Land Services

The Ministry of ATR / BPN has prepared to provide services fully electronically with the issuance of Ministerial Regulations ATR / BPN Number 1 of 2021 concerning electronic certificates. Facts, show that not all of the land documents are ready to become electronic documents



The Concept of Land Service Virtual Counter Design

This counter is a digital land counter that can be accessed online for system users in general by meeting standard operating procedures in accordance with the Regulation of the Head of the National Land Agency Number 1 of 2010.

Transfer of Media for Preparation of Electronic Land Database

In supporting the preparation of the land database towards the electronic document, it is necessary to transfer all land document according to the standard as described in Article 4 paragraph (3) Ministerial Regulations ATR / BPN Number 1 of 2021.

Tensorflow Framework and Object Detection

Tensorflow is a deep learning framework that can be used to create various AI programs. Its use in the field of object detection can simplify the process of constructing, training and deploying an object detection model.

Object detection is a computer vision technique for finding examples of objects in images or videos.

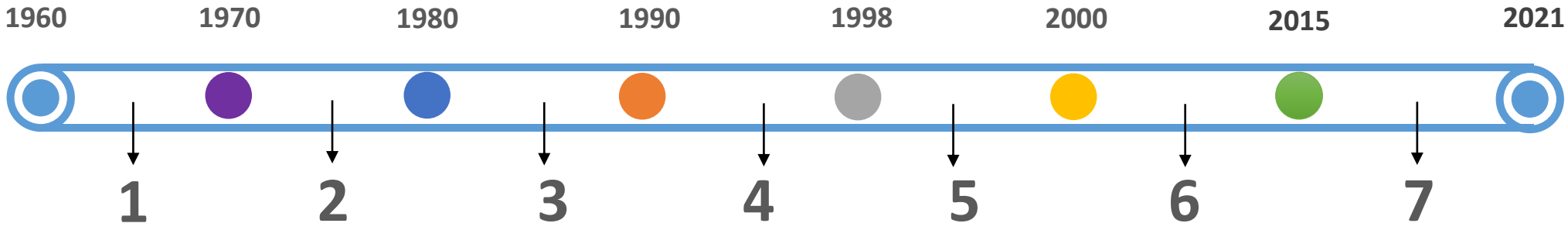
Convolutional Neural Network (CNN)

CNN works in the same way as traditional ANN in that both consist of a set of neurons that optimize themselves from learning. Starting from the initial input to the final result, each network will still express a score or what is called a weight and at the last layer there is a loss function associated with the existing class

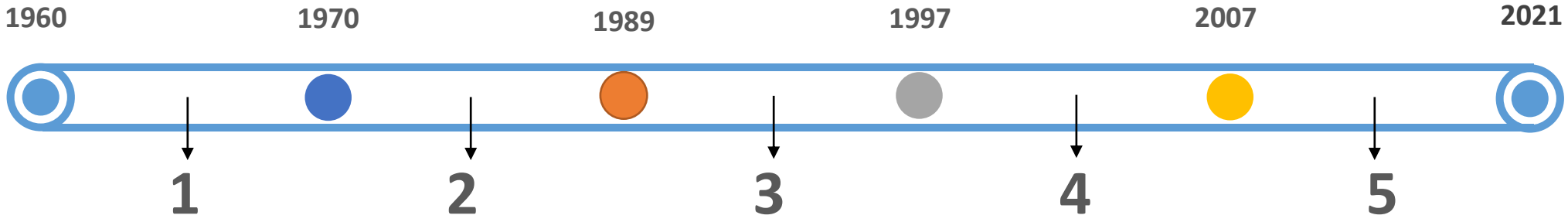
BRIEF LITERATURE REVIEW

In this study, researchers study the changes in the measurement book and land book formats since they were first published in 1960 until now (in Indonesia)

Change of land book format



Change of measurement book format



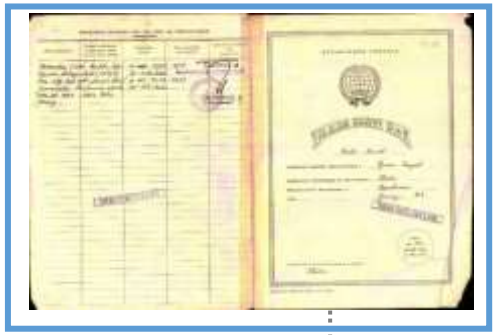
ANALYSIS OF CHANGES IN LAND BOOK FROM 1960 TO 2021

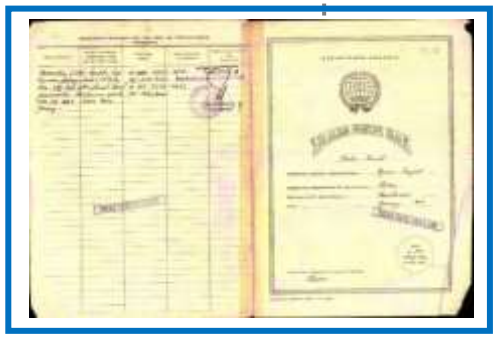
Change of land book format

2016-2021

- The image in the first page of the certificate is Garuda logo, accompanied by the name of the publishing agency: The Ministry of Agrarian Affairs and Spatial Planning/The National Land Agency of The Republic of Indonesia, the title of the cover is 'Land Book', the colour of the paper is green, there is a watermark of 'The National Land Agency'.
- The order of contents in the second page of the certificate is as follows: number and type of the right to the land, the Parcel Identification Number (NIB), origin of the right, basis of registration, measurement letter, the name of the right holder, bookkeeping, issuance of the certificate and designation

First land book format in Indonesia





Second land book format in Indonesia

Third land book format

Fourth land book format

Fifth land book format

Sixth land book format

Seventh land book format

Change of measurement book format

First measurement book format in Indonesia

No data found

2008-2021

- The colour of the paper is green, the title of the third page is measurement book, and a watermark of the National Land Agency current logo;
- The document's number formatting is as follows: number of the measurement letter/year, name of the sub-district, the published year of the measurement letter;
- The third page of the certificate contains the code of right and the right number, serial number of the certificate, meanwhile, on the fourth page of the certificate there is a drawing of the parcel, north orientation and the scale of the drawing.

Second measurement book format

Third measurement book format

Fourth measurement book format

Fifth measurement book format

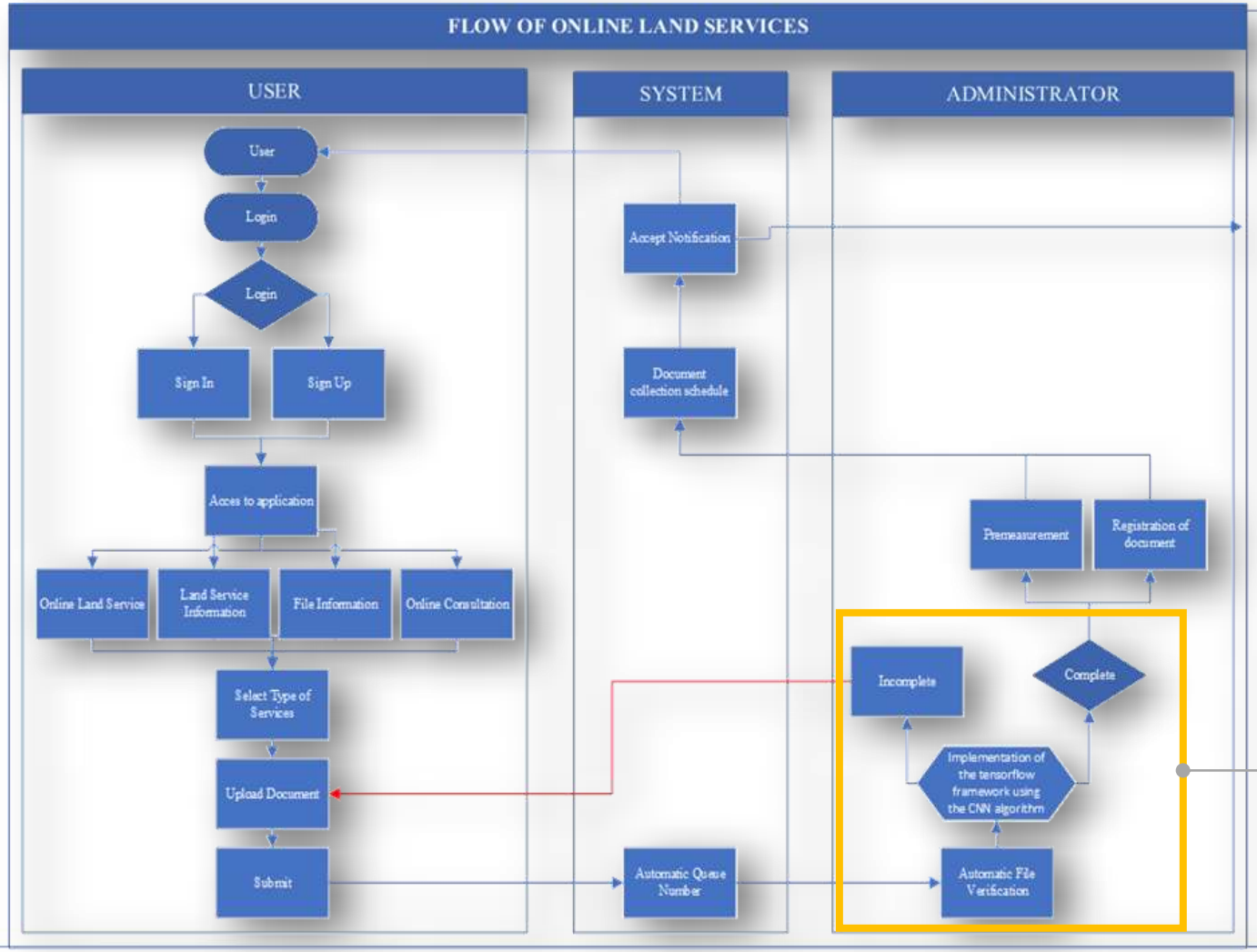
Test the accuracy of the CNN algorithm on land documents

No	Types of land data	Year interval	The total number of objects	Page 1	The number of objects detected is correct	Page 2	The number of objects detected is correct	Page 3	The number of objects detected is correct	Average number detected is correct	Accuracy
1	Land Book	1960-1970	20	20	16	20	16	-	-	16	**0.80**
2	Land Book	1971-1980	20	20	17	20	17	-	-	17	**0.85**
3	Land Book	1981-1990	20	20	17	20	17	-	-	17	**0.85**
4	Land Book	1991-1998	20	20	18	20	18	-	-	18	**0.90**
5	Land Book	1999-2000	20	20	17	20	18	-	-	18	**0.88**
6	Land Book	2001-2015	20	20	18	20	17	-	-	18	**0.88**
7	Land Book	2016-2021	20	20	18	20	18	-	-	18	**0.90**
8	Measurement Letter	1960-1970	20	-	-	-	-	0	0	0	**0.00**
9	Measurement Letter	1970-1989	20	-	-	-	-	20	17	17	**0.85**
10	Measurement Letter	1990-1997	20	-	-	-	-	20	18	18	**0.90**
11	Measurement Letter	1997-2007	20	-	-	-	-	20	18	18	**0.90**
12	Measurement Letter	2008-2021	20	-	-	-	-	20	18	18	**0.90**
Accuracy test results											**0.873**

Based on table 3 above: *it can be inferred that the earlier the documents were published, the lower the accuracy of the object detection. This happens because of the images level of visibility on the older documents are lower than the more recent ones, hence, it influences the object detection process.*

The results of the analysis in the table beside are:

1. In the land book document under 1997. The average number of objects detected was 85% (17 of the total 20 documents that were tested).
2. In the measuring book document, the average number of objects detected under 1997 was 85% (17 of the total 20 documents that were tested).
3. The average value of the object detection accuracy rate in the land book documents testing is 86.4%. While the average value of the object detection accuracy rate in testing measurement book documents was 88.7%.
4. After calculating the average value of the overall object detection accuracy rate (testing the two types of land document), the final accuracy rate is 87.3%.



The position of the tensorflow framework and the CNN algorithm on the virtual land counter

Figure 3. Flowmap of Virtual Land Counter
Source: Researchers' processed data 2021

C O N C L U S I O N

Conclusion of the study

Based on the findings and the tests performed to the system, it can be inferred that both **TensorFlow's Object Detection API and Convolutional Neural Network** are appropriate to use in order to build a system that can identify and classify objects, specifically in this research are land documents: land books and measurement books. The test to determine the level of accuracy of the object detection to the documents based on its type and year showed that the earlier the documents were issued, the lower the accuracy and the reliability of object detection. In addition, the overall average percentage of objects being correctly identified are 87.3%.

ACKNOWLEDGEMENTS

Our gratitude goes to **Achmad Rasis S.** (our patnert) for his contribution to the research by developing the *flow-chart* of a land service virtual counters. We would also like to thank **Head of National Land College**, **The Klaten Land Office,** and **The Surabaya II Land Office** for their permissions to employ their land documents as the object of the research.

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