Sunbird AI Homepage

About Us Portfolio Resources Reports Contact Us

H1	Navigation	Roboto Medium 16pt size

AI Research applied to African problems and social impact.

H2	Header Heading	Roboto Medium 60pt size 67pt leading

An AI & Data Science Research Group based at Makerere University, Uganda.

H3	Header Subheading	Roboto Slab Light 26pt size 34pt leading

HOW WE WORK

H4	Section Heading	Roboto Slab Light 16pt size

About Sunbird AI

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The AI & Data Science research group at Makerere University specialises in the application of artificial intelligence and data science—including, for example, methods from machine learning, computer vision and predictive analytics—to problems in the developing world.

We have carried out research in areas such as the automated diagnosis of both crop and human diseases, auction design for mobile commodity markets, analysis of traffic patterns in African cities, and the use of telecoms and remote sensing data for anticipating the spread of infectious disease.

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The benefits of AI research

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- Intelligence gathering and solutions specifically **applied to African problems**.
- **Open Research** which is publicly accessible.
- **Social impact** for the benefit of the inherent and broader community.

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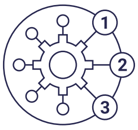
Sunbird AI Homepage



Machine Learning

Remote Sensing Data

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FIND OUT MORE

H4	**Section Heading**	Roboto Slab Light 16pt size

We aim to make AI easy to understand and accessible to the people who directly benefit from it. To better understand the possibilities of AI and how Sunbird AI can solve your problem, have a look at our simple to understand reports.

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Read our simple reports →

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Spatiotemporal models for biosurveillance

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It is useful to know the geographical density of a transmittable disease in order to plan interventions and to predict its future developments. This can be difficult where there is a lack of co-ordinated statistics ...

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Please email us to find an AI and Data Science solution for your problem.

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Website Accessibility Statement **Jobs**

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H10	**Contact Details**	Roboto Light + Bold 18pt size 26pt leading
H1	**Navigation**	Roboto Medium 16pt size

Sunbird AI Text Heavy Page

Automating the segmentation of necrotized regions in cassava root images

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H12 **Article Writers**
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Roboto Slab Regular
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H8 **Button**
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Abstract — *The most common form of symptom measurement in assessment of crop health is visual inspection of the plants. In this paper we discuss a prototypical symptom assessment method for assessing the amount of rot or necrosis in the cross-section of a cassava root tuber. Necrosis is largely associated with the presence of the viral disease Cassava Brown Streak Disease (CBSD), the most dangerous viral cassava disease in Sub-Saharan Africa now. Subjective assessment of symptoms tends to be sub-optimal leading to inaccurate estimates. We propose to automate this task by use of computer vision techniques to standardise the assessment of necrosis. Our work extends previous work in this area in two ways; (i) through the development of algorithms that segment out roots from noisy backgrounds and (ii) we provide improved techniques for identifying necrotic regions in the root as well as evaluating how accurate these methods are.*

Abstract
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Keywords: Segmentation, computer vision, image processing, necrosis

H13 **Keywords**
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1. Introduction

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Cassava Brown Streak Disease (CBSD) is the top viral disease devastating farms and gardens in Sub-Saharan Africa. Estimated losses are in the millions of dollars annually [1]. It affects cassava root tubers, the edible part of the cassava plant, causing brown dead areas (necrosis) that make the roots unsuitable for consumption. A key area of intervention is carrying out surveillance visits and breeding of more resistant varieties of the cassava crop.

To carry out the surveillance or breeding tasks, agricultural experts need to be able to access the extend of necrosis in the cross-section of a cassava tuber. The current methods of assessing the presence and severity of CBSD are based on visual inspection of the root tuber of the plant. To assess a cassava plant, the experts will usually uproot a plant and slice off clean disks from its root tuber. A visual assessment of the root tuber then ensues and results are recorded for the field. A huge challenge with this subjective analysis of disease is that the erroneous diagnosis of disease and its severity can have adverse effects on management decisions such as the inappropriate use of pesticides hence the need for automated techniques of symptom measurement.

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2. Image acquisition

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Building a suitable model to solve this task requires a good but realistic dataset, in this case images taken under ordinary conditions of the field. For this study a total of 40 images of cross-sectional cuttings of CBSD infected cassava tubers were obtained from the National Crops Resources Research Institute (NaCRRI), the government organisation mandated to do research in cassava in Uganda, using the camera application of a Techno C5 mobile phone at a resolution of 8.0 Megapixels. The image data set collected consisted of clean roots that exhibited no symptoms (Fig. 1a), and roots that exhibited the necrosis symptoms of CBSD (Fig. 1b).

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Fig. 1: Examples of clean and necrotic roots collected.

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(a) Clean Root (b) Necrotic Root

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The preferred method of capturing images was to position the camera close to the root so that its cross-section was the focus of the camera lens. Majority of images captured were taken in the field in natural lighting conditions and had a noisy background. For experimental and testing purposes too, a small percentage of the images were captured in a controlled environment i.e, with the background of roots as black cardboard.

3. Development of a necrosis segmentation pipeline

Our goal is to develop a pipeline that can be used to automatically detect a root cross-section from an image of the root with a noisy background and perform a segmentation of the necrotic part of the root providing a score representing how necrotic the cross-section of the root is. The three key phases in this pipeline are; (i) root segmentation from an image of the root in situ, i.e. with a noisy background, (ii) segmentation of the necrotic part of an image of the cross- section of the root and (iii) calculation of the area of the root cross-section that is necrotised. Most of the computer vision algorithms used were standard implementations from the OpenCV library [7] or the SciKit-Image library [8]. Details of the different phases of the pipeline follow.

4.1 Root segmentation iugsdiuvi

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Typically for images of roots taken in situ, one has to deal with the noisy background. Our data collection specifically focuses on such images because the down stream usage of this sort of application will be in the field. It is also a harder problem that extends some of the early work [6] which was done with carefully segmented root images.