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# Runway Detection and Localisation in Aerial Images using Deep Learning

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**Abstract:** *Aerospace industry is one of the biggest growing Boundary Detection. Autonomous Landing, Color Segmentation fields in terms of technology and transport. From a two manned based on state of the art deep learning architectures and also to aircraft in 1900's we have came a long way a d in 2022 we have locate runway using both deep learning architecture and non- commercial, military and UAV's dominating the skies with their deep learning methods. It is a two stage model in which the first respective tasks. In this massively growing field there are many phase is to locate the identified runways using both advantages as well as disadvantages. We all are familiar with conventional line detection algorithms and more recent deep advantages but what about the consequences. The major issues learning methods.in this industry are the accidents and landing failures which takes place due to low cost vision based systems which is being used commonly now a days. So in this project we have came up with the solution that focuses on accurate detection and localization of runway in aerial images and untidy terrain, which will help aerial platforms especially in military drones and UAV's to detect landing targets. The algorithm is based on imageprocessing with lot of assumptions about precise position of runway in a particular image. So the focus was to develop runway detection algorithms Processing, Runway Tracking.*

**Keywords:** Identification, Image processing, Transfer learning, Machine Learning, Convolutional Neural Networks

## I. INTRODUCTION

Unmanned Aerial Vehicles (UAVs) have become very popular during the last few years due to their use in tasks that are too dangerous to be performed by manned aerial vehicles. They, have been used for various purposes other than military such as urban planning, inspection, monitoring, surveying, search and rescue. For successful operation of UAVs without hardware damages, a safe landing operation is essential. To achieve this, vision based approaches for UAV landing have been an active topic in research particularly owing to their ability to provide rich textual information at relatively much less relative cost making them much more suitable for automatic landing problem compared to other sensors. These vision based approaches can be integrated with traditional control techniques for a robust landing approach. Target detection is one of the important tasks in computer vision technology. Typical target detection algorithms are often designed for larger targets such as pedestrians, vehicles, and faces. However, FOD targets often have various damages and no fixed shape, so the features that can be used for detection will be significantly different from traditional targets. Moreover, the detection process tends to have a higher degree of attention to the target materials and hazard levels. The hazard levels of targets with different materials will be significantly different, and for targets with different levels of hazards, the subsequent treatment process will also be significantly different. For example, low-risk items can be removed within a time that does not affect the aircraft's landing and landing arrangements. The global aeronautic sector is increasingly facing a number of safety threats to crews, passengers, and aircraft, owing to foreign object debris , birds, and growing number of drones operating near runways and ancillary airport areas. According to

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the European Commission, the aviation sector experiences costs of approximately US 13 billion/year due to runway detection and bird− aircraftstrikes.

## II. RELATED WORK

In [1], the Author uses Image Processing, Runway Tracking, Boundary Detection. Autonomous Landing. Color Segmentation and applies them appropriately to analyze the image and calculate the required results. In [2], the Author discusses about the overview of the processing steps of the semi-automated approach. Also it describes the processing steps of each approach in detail for ex: Automated image retrieval, Finding preliminary rectangular shaped runway landing site candidates (measures to assess the landing site candidates general safety)

In [3], Author discuss about a Integrated multi source data containing airport locations and remote sensing images were downloaded at corresponding coordinates, and automated methods were used to detect whether these images contain airports with runways or not. Frameworks are used to design and calculate possible ways to manifestate the idea.

In [4], In this paper, the author propose a improved our conventional collaborative security flight control system for multiple drones and presented also the It isa complicated system and the output can be uncertain sometimes. performance evolution results. The proposed method mainly consists of the pattern recognition from the drones' camera images and collaborative drone control to trace other drones.

In [5], Author has used methods optimize the deployment of drone cells, the D2B communication is ignored or idealized in many works, the ultimate purpose of introducing drone-cells into RAN is enhancing users' accessibility to network services.

In [6], Author finds MFCC technique and a classifier based on HMM are employed for feature extraction and classification of drone sounds, utilizing the envelope of the short time cepstral domain Fourier transform (STFT), spectrogram.

In [7], Author mainly focuses Wavelet transform is a popular signal Edge detection is a classical It may take more time than processing method which has been developed in recent years. The good time frequency local characteristics of wavelet transform are very suitable for image processing.

In [8], Author has proposed a method to extract edges more completely and accurately, one image edge detection method based on Fuzzy C-means (FCM) and improved Canny operator in Nonsubsampled Shearlet Transform (NSST) domain is proposed in this paper.

In [9], Author Inspired by Identification of natural and artificial objects in under water images is necessary in order to explore the underwater life because of its various application potentials. Degradation of underwater image because of scattering and absorption in underwater condition makes the objects in under water .

In [10] Author have presented a model to be used to find optimum ruunway exit location is proposed model. It is based on simple searching procedure which is enough for choice of variable domain and value of descrete searching step.

In [11], Author has used methods Runway relative navigation during final approach is a special case where robust and continuous detection of the runway is required. And in Runway marker dete ction method while considering Runway marker especially threshold bars , number of threshold bars indicates the width of the runway and these large long measurements of planes and lands.

In [12], Author mainly focuses on Subjective and objective evaluations reveal that runways can be detected accurately, even in poor visibility conditions due to severe levels of atmospheric turbulence. the author concludes the fusion procedure developed holds strong potential for incorporati on into head-up displays (HUDs) to assist pilots in safely landing aircraft in varying weather conditions.

## III. MOTIVATION

Currently the searching of landing site is the most difficult phase of the flight for any airborne platform. Due to lack of efficient systems, there have been numerous landing accidents resulting in the damage of onboard hardware. Vision

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based systems provides low cost solution to detect landing sites by providing rich textual information. To this end, this research focuses on accurate detection and localization of runways in aerial images with untidy terrains which would consequently help aerial platforms especially Unmanned Aerial Vehicles (commonly referred to as Drones) to detect landing targets (i.e., runways) to aid automatic landing. .

## IV. PROBLEM STATEMENT AND OBJECTIVES

### A. Problem Statement

"To develop a system to analyze terrain and aerial images for possible runway detection using deep learning."

### B. Objectives

- To obtain optimised terrain and aerial images of possible runway tracks..
- To analyse the obtained images and run most accurate algorithms such as CNN for processing of the dataset.
- To use a transfer learning approach for better identification of bird species.
- To improve the landing of UAV aircrafts and safe pathway.

## V. SYSTEM ARCHITECTURE

System architecture is the conceptual model that defines the structure, behavior, and more views of a system. System architecture of our project is System design that defines the system architecture. It also describes the modules and interfaces.

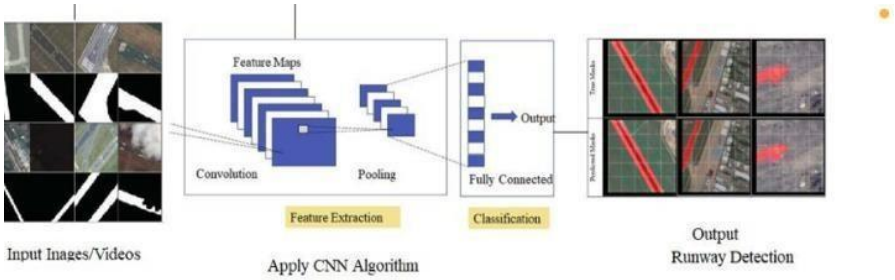


Fig 4.1. System Architecture

In first part(Fig 4.1),A flow of complete detection system was designed. In this project images are gathered in the form of a dataset and then feature extraction is applied on image, after feature extraction a suitable classification is done to get possible runway as well as an approximate analysis of terrain.

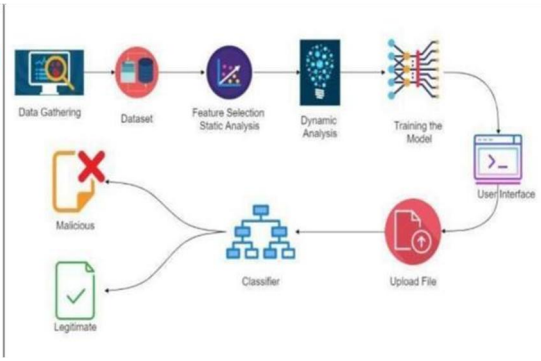


Fig 4.2. Identification through audio data

There are mainly two parts in system Architecture:

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In second part (Fig 4.2), the input image after the extraction of features using the layers like 1.) Convolution Layer 2.) Pooling Layer 3.) Connection Layer which will effectively remove the unnecessary parameters and reduce the complexity of our algorithm and faster execution of the CNN algorithm. The above system architecture provides an insight of how the flow of process will be. Entire process of how the system will move forward that will generate the end result is depicted.

## VI. CONCLUSION

The main idea behind developing the detection system is to reduce the complexity in landing of UAV's and improve landing experience. It also caters to the need of simplifying the runway identification process and thus making detection of runway plane easier. The technology used in experimental setup is Convolutional Neural Network(CNN). It uses feature extraction for image and pixel recognition. The method used is good enough to extract features and detect runway for landing site also calculate the surface hardness.

## VII. ACKNOWLEDGMENT

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