Literature review

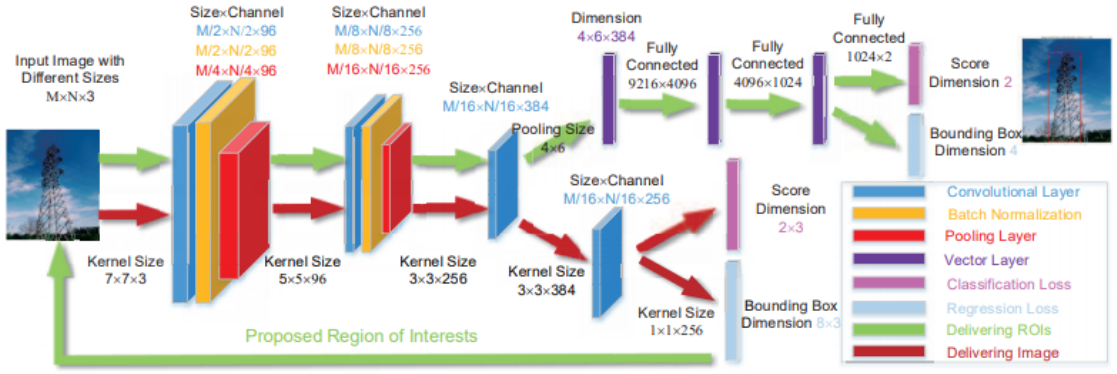
Paper: 1

A Novel Monocular-based Navigation Approach for UAV Autonomous Transmission-line Inspection

The paper implies their main approach is to provide great flexibility for refined inspection and effectively improves inspection safety. In the whole system in a real-world transmission-line inspection scenario under different weather condition and achieve an encouraging result

Problem statements:

1. To locate the effective landmark – transmission tower timely and reliably, they customize a neural network for tower detection and combine it with a fast and smooth tracking.
2. To provide UAV with a robust and precise heading, to detect the transmission lines and compute and optimize their vanishing point.
3. To keep a safe distance from transmission lines, they optimize a homography matrix to restore the parallel nature of transmission lines and perceive the distance variation by a point set registration model.



The tower is regarded as a landmark and robustly located by a customized DL-based Tower R-CNN. Vanishing Point of Power Transmission Lines is calculated and optimized by the Levenberg-Marquardt algorithm used.

Detection Method	Average Precision	Frame Per Second
Faster R-CNN (VGG16)	89.6%	0.8
Faster R-CNN (ZF)	89.5%	2
SSD300	88.9%	6

SSD512	89.2%	2
YOLOv2	86.8%	5.6
Tower R-CNN	89.6%	5

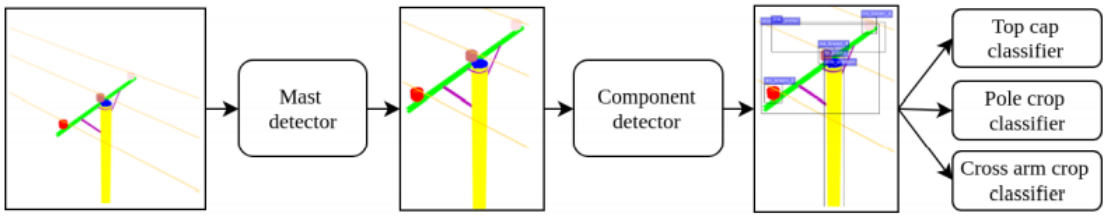
Paper: 2

Intelligent Monitoring and Inspection of Power Line Components Powered by UAVs and Deep Learning

This paper presents a novel automatic autonomous vision based power line inspection system that uses UAV inspection as the main inspection method, optical images as the primary data source, and deep learning as the backbone of the data analysis.

Problem statements:

1. The lack of training data
2. Class imbalance
3. The detection of small components and faults.



Methodology used:

They build their own dataset for training component detection and classification models. And then applied the data augmentation techniques to balance out the imbalanced classes. Finally, they propose multi-stage component detection and classification based on Single Shot Multibox detector(SSMD) and deep Residual Networks (D-ResNet) to detect small components and faults. The model shows the defects on power line components including missing top caps, cracks in poles and cross arms, woodpecker damage on poles, and rot damage on cross arms.

Compared with simple SSD detectors and ResNet50 classifiers, the proposed pipeline with data augmentation achieves 1.2% improvement in terms of mAP on the component detection task; using augmented data to balance out the imbalanced classes improves score in the pole crop classification and cross arm crop classification tasks by 8.7% and 2% respectively.

Paper: 3

Magnetic Field Sensor for UAV Power Line Acquisition and Tracking

This paper presents an automated power line detection system based on the magnetic signature from an active power line.High voltage power line inspection is a critical task that can be automated by using UAV (Unmanned Aerial Vehicle) inspection. A sensor system and a suite of algorithms capable of measuring the distance between the drone and an active power line, as well as the relative bearing. For testing this proposal, the hardware sensor system was implemented, while considering design constraints in terms of both precision and reaction time, as well as weight, power requirements and noise immunity. The hardware prototype and software algorithms were verified in a laboratory set-up. Current measurements show that the distance readings are accurate enough for navigation purposes (97%). This presents an automated power line detection system based on the magnetic signature from an active power line. This paper will discuss the design, testing and fine tuning of a magnetic field sensor system optimized to measure the distance and relative bearing of the power line

Paper: 5

Unmanned aerial vehicle vision-based detection of powerline poles by cpu-based
Deep learning method

Power line detection plays an important role in automated UAV inspection systems, which is crucial for real-time motion planning and navigation along power lines. To overcome from traditional filters and gradients may fail to capture complete power lines due to noisy backgrounds. This method develops an accurate power line detection method using rich convolutional and structured features.
In this paper, it accomplishes deep supervised neural networks and structured features, for accurate power line detection from UAV images. Besides,they release two datasets with pixel-level annotations for evaluation. Leveraging hierarchical and structured features, the method produces both accurate and efficient results, which makes it possible to be applied in practice on UAV onboard platforms.

Datasets : https://github.com/SnorkerHeng/PLD-UAV

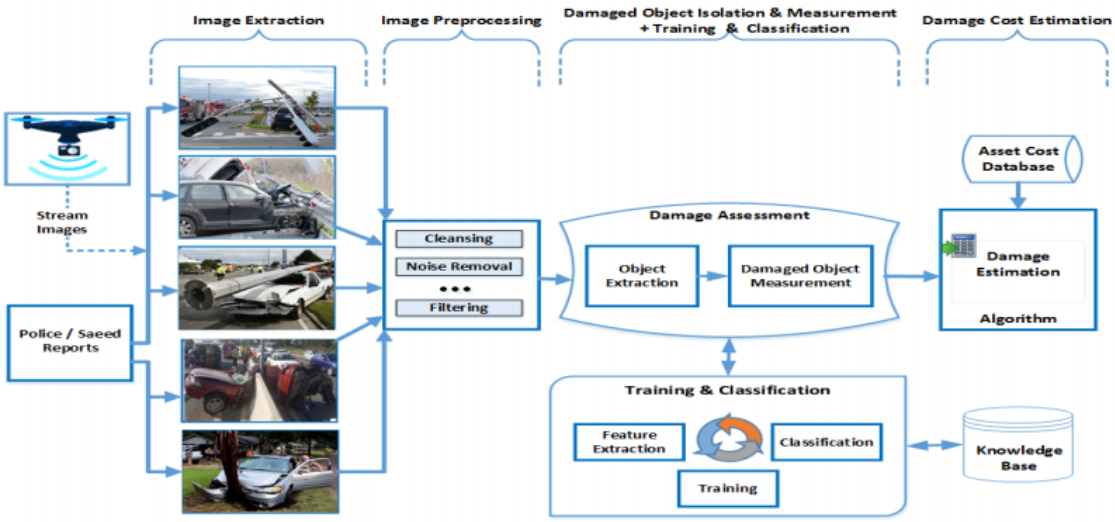
Paper: 6

Drone-Assisted Inspection for Automated Accident Damage Estimation: A Deep Learning Approach

Drones have been used in many application domains nowadays including traffic congestion control, weather information collection, disaster and rescue interventions, and surveillance operations. The drone adoption lies on their capabilities to collect images, videos as well as other sensory data from the air, stream this data to the cloud for processing, and analytics in order to derive important real-time decisions. In this paper, we propose a drone assisted inspection for accident damage estimation based on deep learning approach. Drones are automatically scheduled to visit the accident locations, and data is retrieved for further processing and analytics. We developed a two-phases damage estimation approach, where in the first phase we use deep learning

approach to identify and classify objects from accident's images, and in the second phase we measure the size of damaged objects and we estimate the overall cost of the accident's damages. We evaluated our two-phase approach using data of various accidents, and the classification accuracy we have obtained vary between 0.79 and 0.94 and the accident's damage cost estimation most of time is 100% accepted by the expert.

Hardware	Software
Laptop	TensorFlow
Smart device	Python
Drone	OpenCV
	SQL DB
	Web services
	Map/Location based system



UAV's were heavily used nowadays to support various domains in handling complex, time consuming and critical situations where human intervention is difficult. In this paper, we proposed a drone assisted inspection for accident damage estimation using deep learning approach. We automatically schedule drones to fly to the accident locations, retrieve data (e.g. pictures, videos), and relay it to the cloud for further processing and analytics. We developed a two-phases damage estimation approach, wherein the first phase we use deep learning approach to identify and classify objects from accident's images, and in the second phase estimates and measures the cost of the damage caused by the accident. Unique features of this research involve automatic drone inspection visits and monitoring as well as deep analysis of data for accident's

damage cost estimation. This developed solution allows saving significantly the time while automating the endto-end accident damage identification, classification and damage cost estimate. As future work, are planning to improve the classification accuracy and object measurement while experimenting other classification and damaged object's size measurement techniques. We are planning to build enhance our CNN model by adding more hidden layers, increase the number of nodes and epochs which will definitely improve the prediction accuracy. We are also planning to conduct a comparative study with other benchmarking systems for accident's damage estimation. Finally, we are going to complete the implementation of the full drone inspection system and deploy it on a real environment.