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# Research Peper Reviews -Part 2

## Paper – 5:

**Fault Diagnosis of Power Transmission Lines Using a UAV-Mounted Smart Inspection System**

Published Date : August 30 , 2020

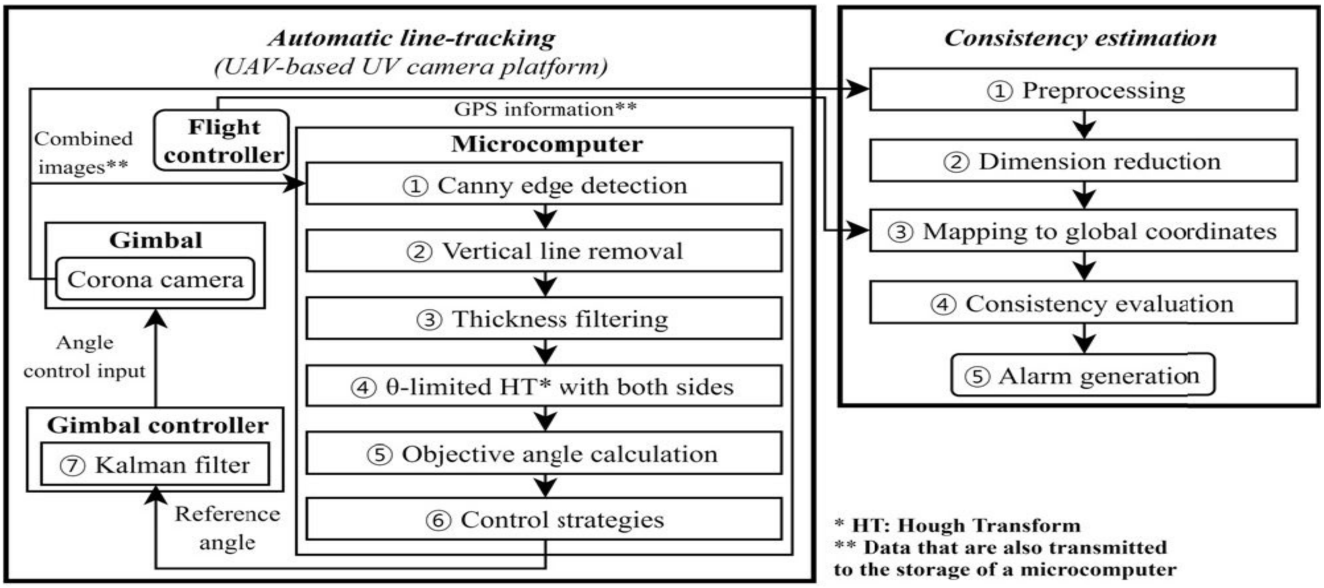
**Objective :**

To detect partial discharge(PD) defect in high voltage transmission line using line tracking drone with UV camera.

**Methodology:**

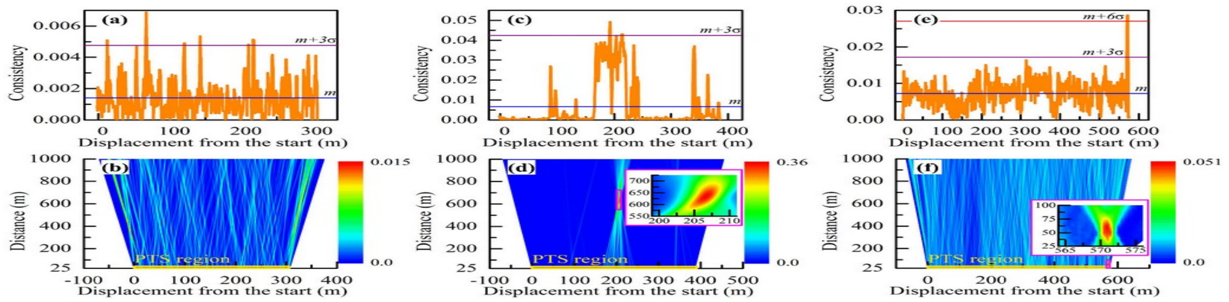
Operation is separated in to two parts.

- Line Tracking (Part A)
- Consistency estimation (Part B)




In Part-A, image is captured and pre-processed for calculating camera angle and drone direction.

In Part-B Transmission line image is captured and combined with UV image. Next, This combined image is pre-processed and mapped with GPS data. After that, Consistency evaluation is performed. Finally, If Partial Discharges in image it will generate alarm.




Above image shows view of Consistency estimation and detected Partial Discharges.

**Conclusion :**
In this paper Part-B is very useful our project. This consistency estimation method is very useful for detecting Partial Discharge problem in Over Head Transmission Line.

## <u>Paper – 6 :</u>

### An Automatic Detection Method of Bird's Nest on Transmission Line Tower Based on Faster_RCNN

Published Date :August 25, 2020

**Objective :**
To detect Bird's nest in Transmission Towers using Faster R-CNN.

**Methodology :**
Normal Faster R-CNN method is used to detect Bird's Nest in Towers.
But , Some Optimization is used in **CNN** and **Pre-Processing**.

**CNN Optimization:**
Authors tried many CNN architecture and gives that model accuracy.

| Network | Total | Correct | Miss | False | Accuracy | Recall | F1 | Detection time(ms/piece) |
|---|---|---|---|---|---|---|---|---|
| Vgg16 | 65 | 61 | 2 | 2 | 96.83% | 93.85% | 95.32% | 101 |
| ZFNet | 65 | 56 | 4 | 5 | 91.80% | 86.15% | 88.89% | 83 |
| ResNet-50 | 65 | 62 | 2 | 1 | 98.41% | 95.38% | 96.87% | 154 |

**Pre-Processing Techniques:**
The following data pre-processing is used to optimize model accuracy.

| Data processing method | Parameters |
|---|---|
| Rotating | +30%, -30% |
| Mirror | Horizontal, vertical |
| Brightness | 120%, 150% |
| Gaussian noise | Mean =1, variance=0.01 |
| Scaling | Linear interpolation, nearest neighbor interpolation, cubic difference |

**Algorithms Used:**

- Faster R-CNN
- CNN (Vgg16 , ZFNet , ResNet)
- Support Vector Machines (Classifier)
- Softmax (Ouput activation function)

**Conclusion :**

This model gives F1-score as 96.87 %. This F1-score is achieved by above data pre-process technique and Resnet-50 architecture as a CNN.

Input data pre-processing and CNN architecture of Faster ~~R-~~CNN is plays major role in ouput accuracy.

## Paper – 7:
## SNIPER Based Multi-Target and Multi-Scale Aerial Image Processing Method

Published Year :2020

**Objective:**

To detect components in power lines with Faster R-CNN and SNIPER.

SNIPER - Scale Normalization for Image Pyramids with Efficient Resampling

**Methodology:**

SNIPER algorithm is added in Faster R-CNN for optimize the speed.

In Faster R-CNN , Muti-scale approach is performed to detect small and Large image. By optimizing this multi scale give more operation speed in Faster-RCNN.

SNIPER is a Efficient multi scaling algorithm.
Speed of Faster-RCNN is achieved by adding this SNIPER algorithm in before of RPN.

**Conclusion :**

| Label name | mAP @0.5[a] | mAR @0.5[a] | quantity | Square root average area (pixel) | Average object scale/image scale | | |
|---|---|---|---|---|---|---|---|
| | | | | | *width* | *height* | *area* |
| Plastic insulator | 0.6135 | 0.6747 | 394 | 413 | 6.807% | 26.040% | 2.054% |
| Glass insulator | 0.6235 | 0.6451 | 2357 | 320 | 10.908 % | 10.235% | 2.045% |
| Grading ring | 0.4710 | 0.5536 | 221 | 144 | 4.947% | 3.632% | 0.455% |
| Dogbone damper | 0.5850 | 0.6306 | 1354 | 99 | 3.396% | 2.300% | 0.169% |
| Occluded damper | 0.0351 | 0.2353 | 175 | 96 | 2.980% | 2.416% | 0.126% |
| Pin bolt | 0.5873 | 0.6183 | 1845 | 88 | 2.046% | 3.917% | 0.117% |
| Pin bottom view | 0.2485 | 0.2745 | 841 | 53 | 1.493% | 2.350% | 0.051% |
| Pin end | 0.1119 | 0.0123 | 312 | 64 | 1.676% | 2.425% | 0.051% |
| Pin defect missing | 0.0098 | 0.0351 | 238 | 40 | 1.026% | 1.403% | 0.019% |
| Pin defect displace | 0.0040 | 0.1667 | 73 | 45 | 1.328% | 1.631% | 0.025% |

[a] Mean average precision or recall at intersection over union at 50%

This SNIPER method performs poor in small object detection and average accuracy in normal objects. It increases the speed ,but decreases the accuracy of model.

Authors says this SNIPER algorithm is perform well in Cascade detection models and gives Good accuracy and speed.

## Paper – 8:

**Transmission Line Scene Classification Based on Light-VGGNet**

Published Year : 2020

**Objective:**

To classify the transmission components and backgrounds with Light-VGGNet.

**Methodology:**

Light-VGGNet is achieved by modifying convalutional kernel and Fully connected layer.

**Modification :**

- Optimized convalutional module(OMC) is used instead of normal convalutional. OMC is nothing but grouped convalutional.
- Only one Fully connected layer is used instead of three layers.
- Average pooling is used instead of maxpooling.

$$\begin{cases} y_1 = F(x_1 + x_2) \\ y_2 = F(x_2) \\ y = x + C(y_1, y_2) \end{cases} \tag{1}$$

where $F(\cdot)$ denotes the convolution operation, and $C(y_1, y_2)$ refers to the concatenation of $y_1$ and $y_2$.

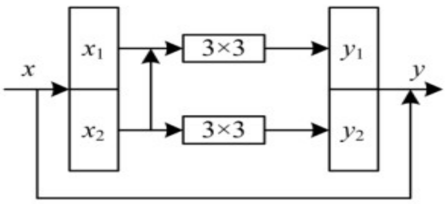



**Figure 1.** The architecture of the OCM.

**Comparison:**

| | Accuracy | F1-measure | Memory consumption | Average running time |
|---|---|---|---|---|
| VGG-16 | 98.80% | 98.80% | 512M | 0.007s |
| Light-VGG-16 | 98.73% | 98.72% | 28.2M | 0.005s |
| VGG-19 | 98.68% | 98.67% | 532M | 0.008s |
| Light-VGG-19 | 98.15% | 98.14% | 38.3M | 0.006s |

**Conclusion:**
Light-VGG16's accuracy is very near to normal VGG16 accuracy. Speed and memory efficient is high in Light-VGG16. Overall performance of Lighter version is good.

## Paper -9:

**Image Detection Technology on Pin Defect to Overhead Power Lines**

**Objective :**
To detect pin defect in Transmission Towers line with modified Faster R-CNN.

**Modification :**
Faster R-CNN is modified with following changes:

- ResNet101 is used instead of VGG16 in Faster- RCNN
- Input image is given in the scale of 1500 x 900

**Performance:**

TABLE 2 TESTING EFFECT OF DIFFERENT DETECTION ALGORITHMS

| *Algorithm* | *Recall(%)* | *Precision(%)* | *AP(%)* |
|---|---|---|---|
| SSD | 0.102 | 0.102 | 0.065 |
| YOLOv3 | 0.347 | 0.944 | 0.401 |
| Faster-RCNN | 0.714 | 0.921 | 0.682 |
| Ours | 0.857 | 0.898 | 0.788 |

**Conclusion:**
Modified version of Faster R-CNN gives around 89% Precision. ResNet101 works well compared to other CNN architectures.