ANALYSING AND IMPROVING EFFICIENCY OF PRODUCTION IN MANUFACTURING INDUSTRIES USING ARTIFICIAL INTELLIGENCE METHODOLOGY WITH REAL-TIME IMPLEMENTATION

D. Vetriselvi[1], G. Amirtha Visali[2], T. Deepika[3], R. Dhiviya[4]

[1]Assistant Professor, Dept. of Computer Science and Engineering, Jeppiaar SRR Engineering College, Chennai
[2,3,4] Final Year Student, Dept. of Computer Science and Engineering, Jeppiaar SRR Engineering College, Chennai

---***---

Abstract – *India has been in an Industrial race for the past two and half centuries not unfortunately it has been a race to the bottom. Finally, more importantly, relevant for India the manufacturing Industry in India creates more employment opportunities with its growth than any other sector. Insite our research shows us is that manufacturing need economies are much more resilient and robust. And one of the major criteria to consider is manufacturing the goods and delivering them at proper lead time. To achieve the tracking of goods production and It is on-time delivery is required to be taken care of. For that technology needs to be integrated with the manufacturing leading to its tremendous improvement. In this research, we propose a system to automatically track and trace each step of the manufacturing and the time is taken in the completion of each step. If the Threshold time limit exit for any step in the process then an automatic Mail/SMS will be sent to the manufacturer using SMTP Protocol/API software to automatically take the step for the process to complete on time. This is attained by implementing object tracking methodology in Industries.*

***Key Words*: Object tracking, Threshold Time, SMTP Protocol, API Software.**

1. INTRODUCTION

A Manufacturing process is a way a business will initiate how it will produce its products for its customers. Manufacturing process requirements are been completed by operation personnel. Requirements of the facilities and the processes and related cost are been identified to enable building production units according to the requirements of volume, time, and safety. The Manufacturing Process is the steps through which raw materials are been converted into a final product. The manufacturing process begins with the product design, and material description from which the product is being manufactured, and these materials are then modified through manufacturing processes to become the required part. The manufacturing sector is been closely connected with Engineering and Industrial design.

Production planning and control is an encoded process that plans, managers, and controls the distribution of human resources, raw materials, and machinery to achieve maximum efficiency. A production line is a traditional method, which people subordinate with manufacturing. The production line has been arranged so that the product is moved successively along the line and stops at work centers along the line where an operation is performed. The item may along some way of conveyor, are been moved manually by staff. For example, operations along the production line could comprise assembly, painting, drying, testing, and packaging.

1.1 Key factors affecting Production Time

Loss of Production speed is an inevitable reality for process manufacturers. Reduced production speed shows to consume 9-15% of available production capacity in various production contexts and create considerable cost for capital-intensive process Industries. Amongst the inspected of the six big efficiency losses measured within total productive maintenance, speed loss presents significant opportunities for potential efficiency improvement in manufacturing companies. Based on the Works, this paper presents a context of the factors related to speed loss, including three overall dimensions: technology factors, human factors, and product factors.

1.2 Production and manufacturing

Production is alike to Manufacturing but broader in scope. It refers to the processes and techniques that are bee used to convert raw materials are semi-finished goods into finished products or services with or without the use of machinery. Manufacturing production refers to the methodology of how to most proficiently manufacture and produce goods for sale, beyond just a bill of materials. Three mutual types of manufacturing production processes are: Make to stock (MTS), Make to order (MTO), and Make to assemble (MTA). Such strategies have its own advantages and disadvantages in labour cost, inventory control, overhead, customization, and the speed of production and filling orders.

2. RELATED WORKS

[1]Multi-Stream Siamese and Faster Region-based Neural Network for Real-Time Object Tracking, Yi Liu, Liming Zhang, Member, IEEE, Zhuhai Chen, Yan Yan, Member, IEEE, and Han Zi Wan, Senior Member, IEEE[2020, Vol. No.: 1524-9050]

Traffic Scene perception(TSP) aims to extract accurate real-time on-road environment information which involves three phases: Detection of an object of interest, Recognition of detected objects, and tracking of an object in motion. Since recognition and tracking often rely on the results from deduction, the ability to detect an object of interest effectively plays a crucial role in TSP. In this paper, we focus on three important classes of objects: Traffic signs, Cars, Cyclists. We propose to detect all the three important in a single learning-based detection framework. The proposed framework consists of a dense extractor and detectors of three important classes. Once the dense features have been extracted, these features are shared with all detectors. The advantage of using one common framework is that the detection speed is much faster since all dense features need only be evaluated once in the testing phase. In contrast, most previous works have designed specific detectors using different features for each of these three classes. To enhance the feature robustness to noises and image deformations, we introduce spatially pooled features as a part of aggregated channel features. To further improve the generalization performance, the proposed and object subcategorization method is a means of capturing the intraclass variation of objects. We experimentally demonstrate the effectiveness and efficiency of the proposed framework in three detection applications: Traffic Sign detection, Car detection, and Cyclist detection. The proposed framework achieves the competitive performance with state-of-the-art approaches on the benchmark dataset.

[2] Object Detection in High-Resolution Remote Sensing Imaginary Based on Convolutional Neural Networks with Suitable Object Scale Features, IEEE Peng Pang, Chunyu Wang Xinggang Wang, Wenyu Liu, Wenjun Zeng, and Jinggong Wang [2019, Vol No.: 0196-2892] Object Detection in High Spatial Resolution Remote Sensing Images is an important part of image information automatic extraction, analysis, and understanding. The region of Interest (ROI) scale of object detection and the object feature representation are two vital factors in HSRI object detection. Concerning these two issues, this article presents a novel HSRI object detection based on the Convolutional Neural Networks (CNNs) with suitable abject scale features. First, the suitable ROI Scale of object detection is obtained by compiling statistics for the scale range of objects in HSRRIs. Then, a CNN framework for object detection in HSRIs is designed using a suitable ROI scale of object detection. The object features obtained using a CNN have good universality and robustness. Finally, a CNN framework with a suitable ROI scale of object detection is trained and tested. Using the WHU-RSONE dataset, the proposed method is compared with the faster region-based CNN(Faster-RCNN) framework. The experimental results show that the proposed method outperformance the faster-RCNN framework and provides good object detection results in HSRRIs.

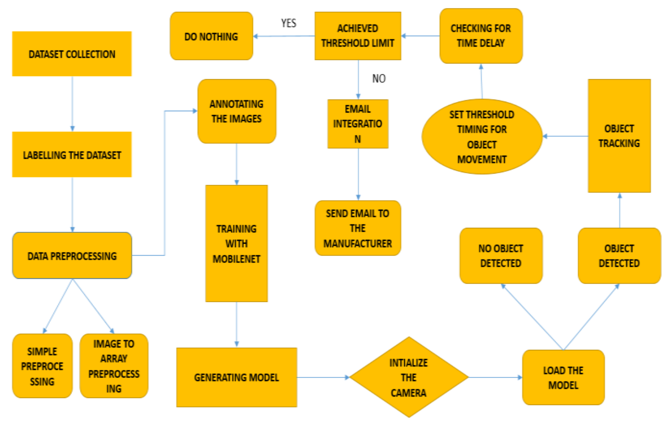
[3] Deeply Supervised Salient Object Detection with Short Connections, Quibin Hou, Ming-Ming Cheng, Xiaowei Hu, Ali Borji, Zhuowen Tu, Philip H. S. Torr [2018, Vol No.: 0162-8828] recent progress on salient object detection is substantial, benefiting mostly from the explosive development of Convolution Neural Network(CNN). Sematic segmentation and salient object detection algorithms developed lately have been mostly based on Fully Convolutional Neural Networks (FCNNs). There is still a large room for improvement over the generic FCN models that do not explicitly deal with the scale-space problem. Holistically-Nested Edge Detector (HED) provides a skip-layer structure with deep supervision for edge and boundary detection, but the performance gain of HED on saliency detection is not obvious. In this paper, we propose a new salient object detection by introducing short connections to the skip-layer structure within the HED architecture. Our framework takes full advantage of multi-level and multi-scale features extracted from FCNs, providing more advanced representations at each layer, a property that is critically needed to perform segment detection. Our method produces state-of-the-art results on 5 widely tested salient object V detection benchmarks, with advantages in terms of efficiency (0:08 sec per image), effectiveness, and simplicity over the existing algorithms. Beyond that, we conduct an exhaustive analysis on the role of training data on performance. Our experimental results provide a more reasonable and powerful training set for future research and fair comparisons.

[4] Spatio-Temporal Gaussian Process Models for Extended and Group Object Tracking with Irregular Shapes, Waqas Aftab, Roland Hostettler, Member, IEEE, Allan De Freitas, Mahnaz Arvaneh, and Lyudmila Mihaylova, Senior Member, IEEE [2018, Vol No.: 0018-9545] Extended object tracking has become an integral part of many autonomous systems during the last two decades. For the first time, this paper presents a generic Spatio-Temporal Gaussian Process (STGP) for tracking and irregular and non-rigid extended objects. The complex shape is represented by key points and their parameters or estimated both in space and time. This is achieved by a factorization of the power spectral density function of the STGP covariance function. A new form of the temporal covariance kernel is derived with the theoretical expression of the filter likelihood function. Solutions to both the filtering and the smoothening problems are presented. A thorough evaluation of the performance in a simulated environment shows that the proposed STGP approach outperformance the state-of-the-art GP extended Kalman Filter approach [1], with up to 90% improvement in the position accuracy, 95% in velocity, and 7% in shape, while tracking a simulated asymmetric non-rigid object. The tracking performance improvement for a non-rigid irregular real object is up to 43% in position, 68% in velocity, 10% in the recall, and 115% in the precision measures.

3. PROPOSED SYSTEM

The Proposed method is built in an Artificial Intelligence Model to improve and analyze the efficiency of production in manufacturing Industries. Our Method has the goal of monitoring the manufacturing product's motion and the time of completion. Detect any kind of manufacturing product and track using the threshold timing. Point to point tracking from one manufacturing section to another using object tracking. The Mail/Message Integration automatically intimate a manufacturer about the delay in production at every point in time. Finally, it highlights some of the observations on future research issues, challenges, and needs.

4. PROPOSED ARCHITECT



5. MODULES AND DESCRIPTION

5.1 Dataset Collection Module

Dataset Collection is a collection of data. Deep Learning has become the go-to technique for solving many challenging real-world problems. It's definitely by extreme the best-performing method for computer vision tasks. The image above cabinets the power of deep learning for computer vision. With enough training, a deep network can segment and identify the "Key Points" of every person in an image. These deep learning machines that have been working so well need energy lots of fuel; that fuel is data. The more labeled data available, the better our model performs. The Idea of more data to better performance has even been explored at a large scale by google with a dataset of three hundred million images' when deploying a deep learning model in a real-world presentation, data must be constantly fed to continue improving its performance. And, the deep learning era, data is very well arguably the most valuable resource.

5.2. Training the model with Algorithm

SSD(Single Shot Multi-box Detector) is a common algorithm in object detection. It is generally quicker than Faster RCNN. In this post, I will give you a brief about what is object detection, Tensorflow API, what is the idea behind neural networks, and specifically how SSD architecture works. The SSD architecture is a single convolution network that acquires to forecast bounding box locations and classify these locations in one pass. Hence, SSD can be trained end-to-end. The SSD network comprises of base architecture(MobileNet in this case) followed by several convolutional layers.

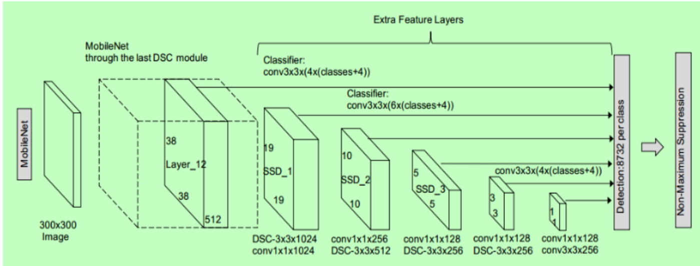


Fig. 1. MobileNet SSD architecture

By using SSD, The only need to take one single shot to identify various objects within the image, while regional proposal network (RPN) based approaches such as R-CNN series that need two shots, one for producing region proposals, one for detecting the object of each proposal. Thus SSD is much quicker compared with two-shot RPN-based approaches.

5.3 Object Detection

Object detection is a process of revealing all the probable instances of real-world objects, such as human faces, flowers, Cars, etc., in images or videos, in real-time with utmost accuracy. The object recognition technique uses subsequent features and learning algorithms to recognize all the occurrences of an object category. Object detection technique helps in the recognition, detection, and localization of numerous visual instances of an object in an image or a video. It provides a much greater indulgent of the object as a whole, rather than just basic object classification. This method can be used to total the number of instances of unique objects and mark their accurate locations, along with labeling. With time, the presentation of this process has also improved meaningfully, helping us with real-time use cases.

Multi-scale detection of objects was to be done by taking those objects into attention that had "different sizes" and "different aspect ratios". This was one of the main technical experiments in object detection in the early phases. But, after 2014, with an growth in technical advancements, the problem was solved. This brought us to the second phase of object detection, where the responsibilities were accomplished using deep learning.

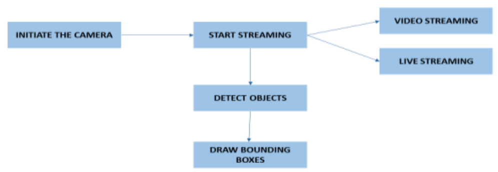


Fig. 2. Object Detection

5.4 Object Tracking

Object tracking is a chastisement within computer vision, which frames. Objects are frequently people, but may also be animals, vehicles, or other objects of interest, such as the ball in a game of soccer. Below are Impressive results attained by SORT, a Deep Learning object tracking algorithm. Technically, object tracking starts with object detection-identifying objects in an image, and assigning them bounding boxes. The object tracking algorithm assigns an ID to each object Identified in the image, and the subsequent frames try to carry across this ID and identify the new position of the same object.

There are two main types of object tracking:

- **Offline Object tracking**—object tracking has been on a recorded video where all the frames, including forthcoming activity, are known in advance.
- **Online Object tracking**—object tracking has been done on a live video stream, for example, a surveillance camera. This is more thought-provoking because the algorithm must work fast, and it is impossible to take future frames and combine them into the analysis.

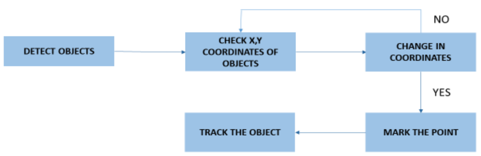


Fig.3. Object Tracking

5.5 Email Integration

For Integrating email the SMTP protocol is used for sending and receiving mail as configured by us.

Simple Mail Transfer Protocol (STMP)
SMTP is a standard protocol for providing email services on TCP/IP networks. This server provides the ability to send and receive email messages. SMTP is an application-layer protocol that offers the delivery and transmission of email over the internet. It is sustained by the Internet Engineering Task Force (IETF). SMTP is generally added within an email client application and is composed of four key components:
1. Local User or Client-end efficacy is known as the Mail User Agent (MUA),
2. Server Known as Mail Agent (MSA)
3. Mail Transfer Agent (MTA)
4. Mail Delivery Agent (MDA)
Getting email alerts is a set of data using the Raspberry Pi Python program is a very useful application. All that is needed is the SMTP library in the python script. There are many versions of python but pi is more compatible with 3.2, and 2.7 versions of it.

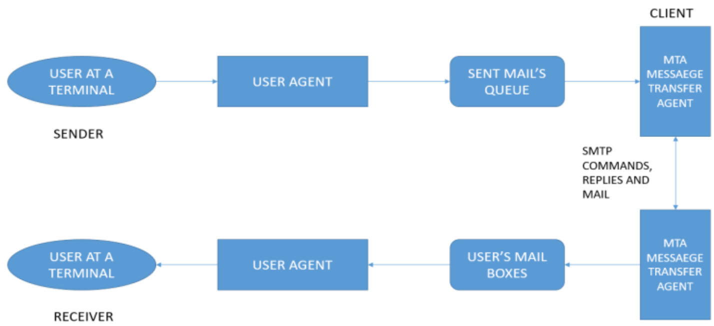


Fig. 5. Email Integration

5.6. SMS Integration

An SMS API is a precise software interface that enables code to send short messages via an SMS gateway. As the infrastructure for SMS communications and the internet are habitually divided, SMS APIs are habitually used to 'bridge the gap' between telecommunications carrier networks and the wider web. SMS APIs are used to allow web applications to simply receive and send text messages through logic written for standard web frameworks. We will be using TextLocal SMS API for our integration which enables us to easily integrate our SMS services, software, or CRM application in PHP, ASP.net, Java, or any other language. The integrated solution of TextLocal and Optimove makes it easy to plan and execute marketing text message campaigns, based on the advanced customer segmentation available in Optimove.

Optimove connects to the TextLocal system for two purposes:

1. To instruct TextLocal to execute TextLocal campaigns, i.e., to send out particular text message templates to specified customer lists.
2. To receive delivery metrics from TextLocal for reporting within Optimove.

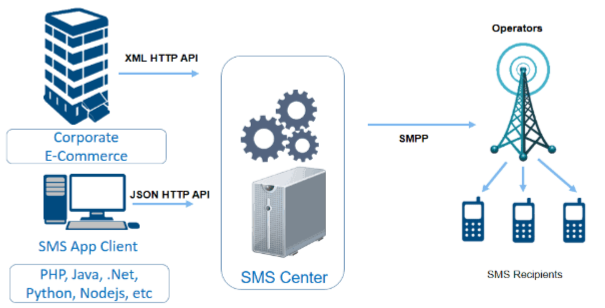


Fig. 6. SMS Integration

6. RESULTS

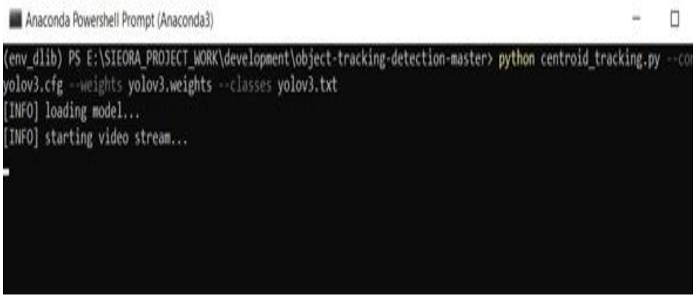


Fig. 7. Model Loading

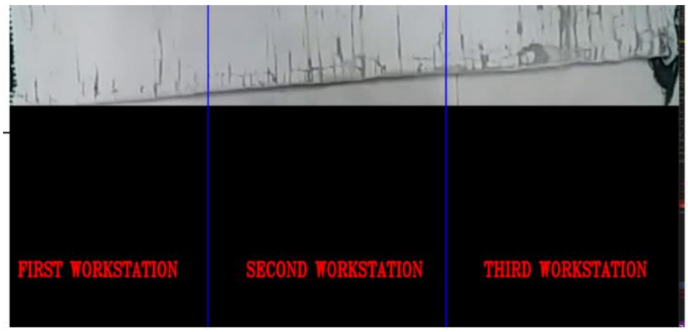


Fig. 8. Video Frame

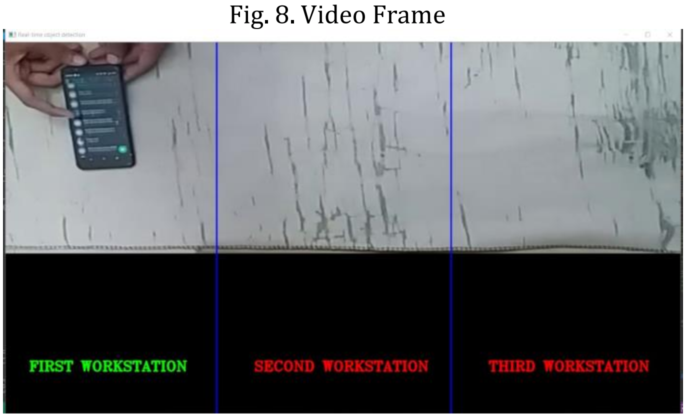


Fig. 9. Object detection at First Work station (No Delay)

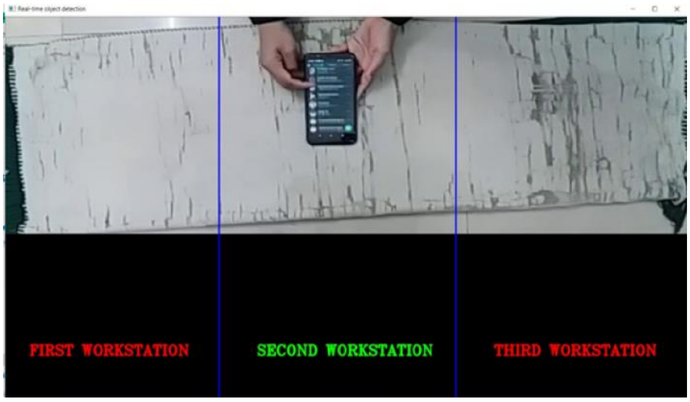


Fig. 10. Object Detection in Second Work Station (delayed)

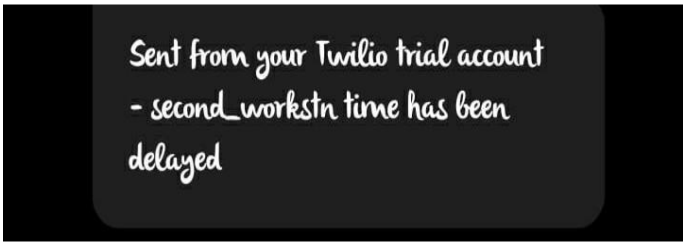


Fig.11. SMS for the delay in Second Work Station

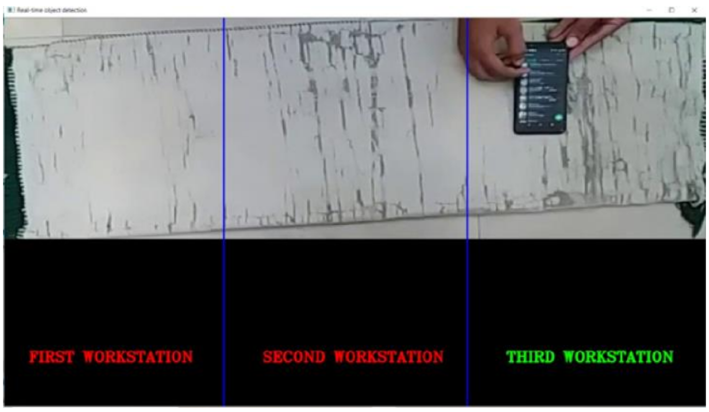


Fig.12. Object Detection in Third Work Station

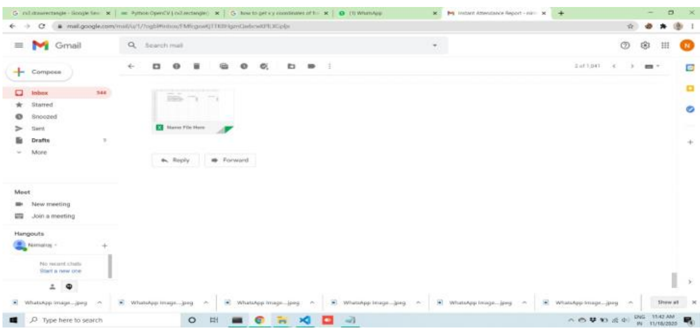


Fig.13. Report send to the Mail

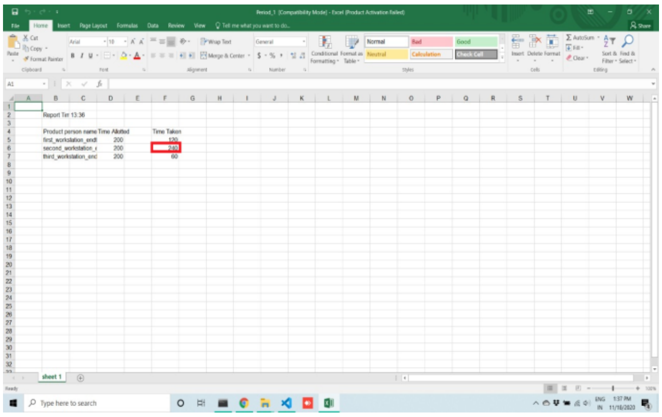


Fig. 14. Report with Delay via Mail

7. CONCLUSION

This paper is successfully implemented for effective monitoring of work states in the manufacturing sector using the Artificial Intelligence approach. This paper is very useful in reducing the burden on the management of constant monitoring and also any possibility of human error is removed. In Future enhancement, we review the application of the production technology in the manufacturing field and it can promote the advancement of the manufacturing technology with more accuracy. In this field, there is more chance to develop or convert this paper in many ways. Thus, this paper has an efficient scope in the coming future where this idea can be cheaply converted to computerized production.

8. REFERENCES

[1] Yi Liu, Liming Zhang, Member, IEEE, Zhihui Chen, Yan Yan, Member, IEEE, and Hanzi Wang, Senior Member, IEEE "Multi-Stream Siamese and Faster-Based Neural Network for Real-Time Object Tracking" [2020, Vol. No.:1524-9050]

[2] IEEE Peng Pang, Thunyu Wang, Xinggang Wang, Wenyu Liu, Wenjun Zeng, and Jingdong Wang "Object Detection in High-Resolution Remote Sensing Imaginary Based on Convolutional Neural Networks with Suitable Object Scale Features"[2019, Vol. No.: 0196-2892]

[3] Qibin Hou, Ming-Ming Cheng, Xiaowei Hu, Ali Borji, Zhuowen Tu, Philip H. S. Torr "Deeply Supervised Salient Object Detection with Short Connections"[2018, Vol. No.: 0162-8828]

[4] Waqas Aftab, Roland Hostettler, Member, IEEE, Allan De Freitas, Mahnaz Arvaneh, and Lyudmila Mihylova, Senior Member, IEEE "Spatio-Temporal Gaussian Process Models for Extended and Group Object Tracking with Irregular Shapes" [2018, Vol. No.: 0018-9545]

[5] Yunhan Shen, Rongrong Ji, Senior Member, IEEE, Changhua Wang, Senior Member, IEEE, Xi Li, and Xuelong Li, Fellow, IEEE "Weakly Supervised Object Detection Via Object-Specific Pixel Gradient" [IEEE 2018, Vol. No.: 2162-237X]