COMP 6961

Graduate Seminar Report

Recognition of Geographical Wartegg Hand-Drawing

Speaker: Yunqi Xu

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Student Name: Anuj Kharit

Student ID: 40228592

ABSTRACT

In this seminar, the speaker Yunqi Xu presents his research of using Recognition of Geographical Wartegg Hand-Drawing. The speaker talked about the Wartegg is classic psychology test that can help for selection of personnel. To perform this test, Questionnaire are printed on A4 paper and having 4cm x 4cm squares with printed signs drawn by pencil. Further, Speaker talked about the meaning of printed sign on 4cm x 4cm squares. Moreover, Yunqi Xu talked about the literature review for objection detection and hand-drawn images. For datasets Collection, draw clean Wartegg test with pencil and scanned into computer and saved it digitally. For description and difficulties, she talked about the abstraction and complexity, lacking color information, diversity, and deficiency in training images. She talked about the Quick Draw is one of the biggest open-source hand-drawn image. In methodology and result she compared about the binary image and PCC. Further she discussed about SLIC algorithm and DBSCAN algorithm. Initially the parameter provided by the alpha cells are transferred in darknet53 framework. This will increase coverage of night work and then transferred to QuickDraw images and these images train by YoloV3-SPP for detection. For future work, speaker will add more categories for detection, focus on training small image set, generating stylish sketch images, colorize hand-drawn images and let machine describe an image several words or sentences. In this report, I aim to explore and document the research presented by the speaker in further detail.

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INTRODUCTION

The Wartegg test is a psychology personality test, and it is frequently used in selection of personnel. It was designed by the Erik Wartegg in the 1930s. This test is easy to understand and implement. The tests include 8 squares box with different symbol. At the end of this test, it represents how individual perceives himself, their interpersonal relationships, ambitions, behaviour, and intellectual capacity. The 8 squares box have their own meaning regards to personality of persons.

Box 1: A small dot(point) reflects person self-identity, ego, and their relationship with others.

Box 2: A small curve represents emotional expression towards society and liveliness.

Box 3: The straight lines show the aspiration, eagerness, goal oriented and achievements.

Box 4: A solid square box which represents to obstacles or problem, challenges, and difficulty.

Box 5: Two perpendicular lines indicates conflict, aggression, and opposition.

Box 6: Two perpendicular lines that are not intersect each other represents person's ability to find out the potential relationships refers to kindness.

Box 7: A series of point related to protection. How person's feels protected and how he defends himself.

Box 8: A radical curve refers to the text in the entries may be of any length.
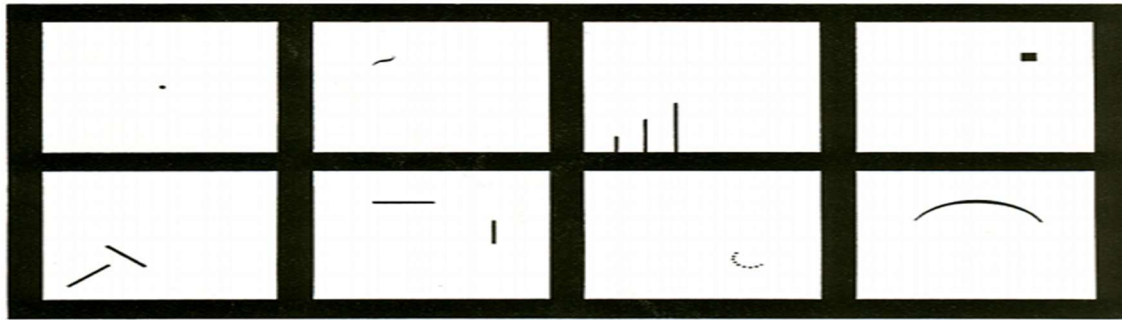
Boxes 1 and 8 are reflecting person's self-image. It helps to understand person's aim and goal. Boxes 2, 3 and 7 represents person's emotions. Boxes 3 and 5, can refers productivity and ability and at last boxes 4 and 6 refers attitude towards the world.

Problem Statement

Personality tests are often required to have insight knowledge about the people are, along with what motivates them. In organization, for employer perspective, understanding of the person personality which shed on light of his work style and how he may fit in their work culture. So, some personality tested have been conducted since many years to identify people behaviour and thought process. Wartegg Test is one of easy to implement and having good result to identify the people personality.

Objectives

As stated in the introduction, the objective of this study is to Recognition of Geographical Wartegg Hand-Drawing. The objective of this study was to understand a complete framework "Wartegg Hand-Drawing and their concepts".

Literature Review:

Since many years Wartegg Test have benefited to many people to identify people personality. Initially test was developed by Ehrig Wartegg in 1926 and then after so many psychologists have conducted research and added more details into the test. As below image refers the evolve or improvement of Wartegg test during the years.
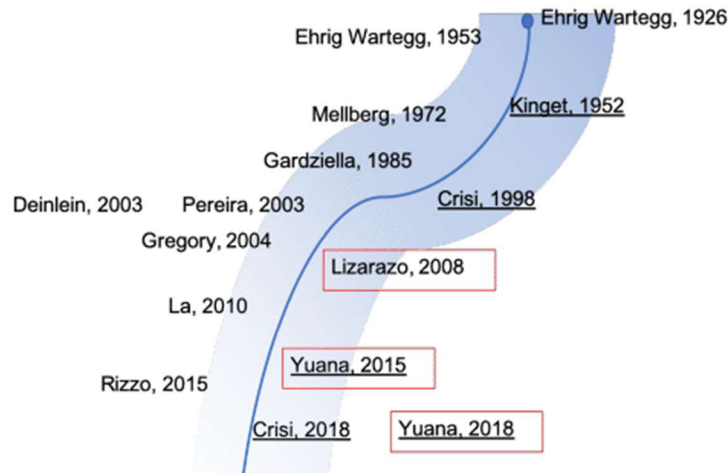
Limitations

- Using object detection algorithm which helps to recognizes 80% to 90 % correct data. Require or need of some algorithm which have better results.

BACKGROUND

Deep Learning

Deep Learning is a way to used in artificial intelligence to create the system that can understand human behavior. The aim is to create such an intelligent system that can learn and understand the design of hand drawn. Artificial intelligence consists of machine leaning, deep leaning and data science. With the help of deep learning its easy to implement the neural networks. An neural network contains neuron arranged in layer structure format following forward propagation and back propagation methodology. In forward propagation, a weighted input from the previous layer

and biases are added and inserted into an activation function to introduce nonlinearity in the output. After this step, the network is trained by backpropagation - the process of reducing the cost induced by the network because of generating incorrect output.

Object Detection

Object Detection is belonging to computer vision field which deals with realization and classification of objects. Object can be images and videos. There is difference between image recognition and object detection. They both are part of neural networks but having some difference. Image recognition sends a whole image through a classifier for spit into tag. This classifier takes whole image, but it did not tell you where the tags are. However, in object detection it creates a bounding box around the classified object. For example, below image shows how image recognition and object detection works.

Object detection is linked with other similar computer vision techniques like image segmentation and recognition and help to understand images or video.

The object detection can be used in other field as well like video surveillance where object detection techniques can identify and track multiple instances of a given object
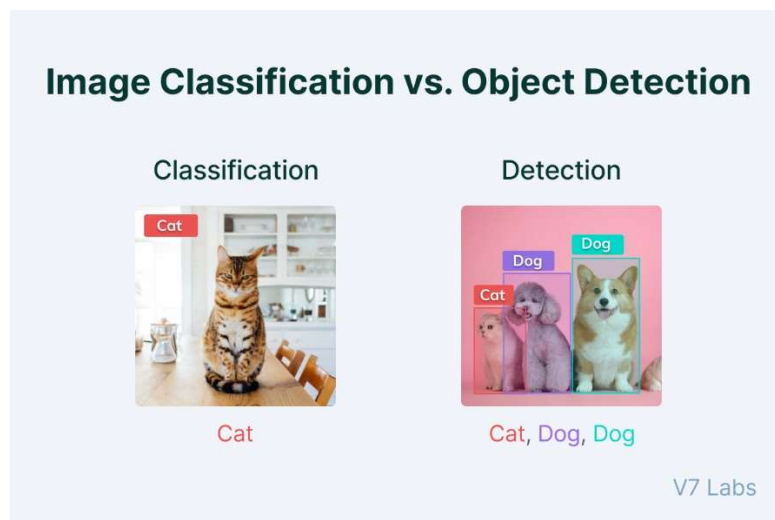
Before deep learning took off in 2013, almost all object detection was done through machine learning technique. Object is divided into two parts are as follows:

- Single – Stage object detector
- Two - stage object detector

In the below diagram, it shows the types of object detection.
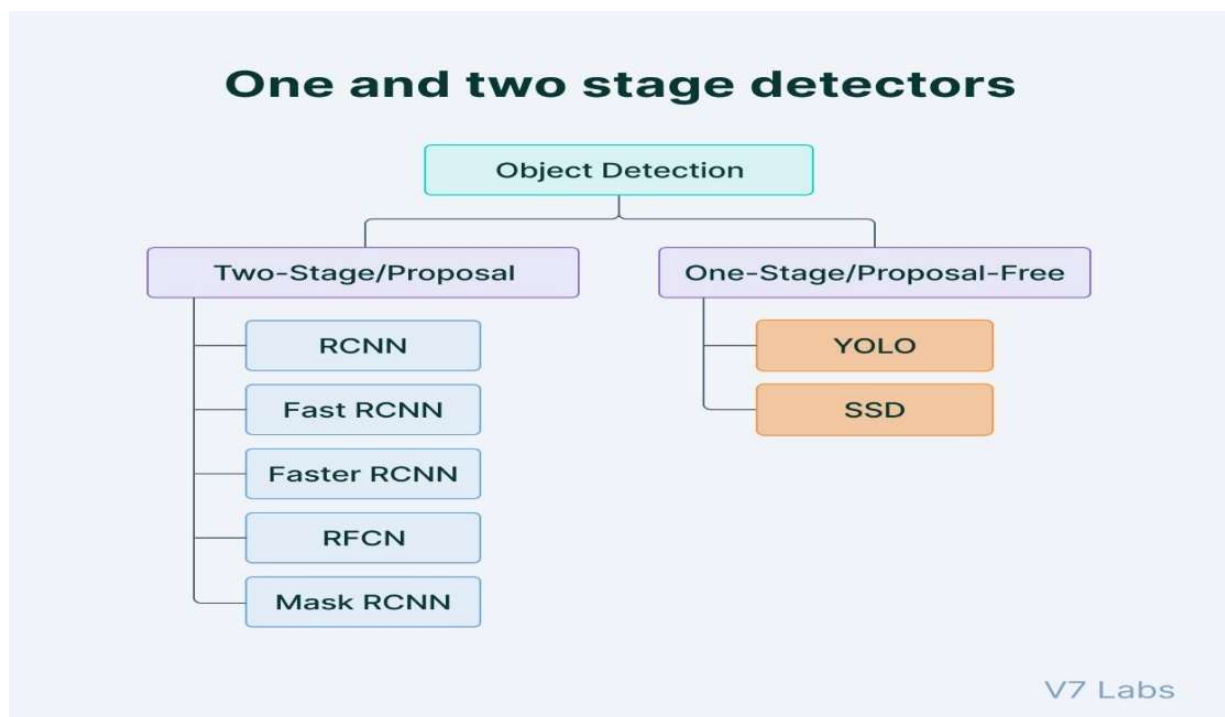
In the above diagram, it shows the types of object detection methods. YOLO (you only look once) is use more often for real-time detection.

TECHNICAL CONTRIBUTIONS AND RESULTS

Technical contributions for case study 1: Wartegg Test using computer- aid

In terms of research using computer – aid Wartegg test, only few researchers have tried to change the Wartegg Test into the computer-aid. In 2008, Campos created the electronic version WDCT form and made it possible for a psychologist to organize it electronically. This is first attempt Wartegg test to computer-aid software applications. In 2015, Yuana proposed the Fast Wartegg Analyzer Tool (FWAT), which was web based Wartegg test proposed system. It consists of PHP and MYSQL technology which helps clients to access web-based system with internet. In 2020, Lili Liu tried to combine Wartegg Test with artificial intelligence and image processing technology to automatically analyze the results by Wartegg test to provide psychologists with numerical and quantitative analysis.

They proposed Computer-aided Wartegg Drawing Completion Test Framework, a fully automatic system which is based on digital image processing and machine learning techniques. This system requires 8 boxes of Wartegg Test form.

Then, five predefined features are taken from each box then, these features are processed for analysis to provide better understanding of personality traits. With the help of Watershed Scissor algorithm, it is possible to scan the drawn- image.

Input Image of scanned Wartegg Test Questionnaire Form.

Step 1: Finding contours from gray input images.

Step 2: Matching the pre-defined black border rectangle template and filter target shape from matched out results.

Step 3: Cutting the form (target shape) out and compute its rotation angle.

Step 4: Form rotation correction and Warp Affine.

Step 5: Compute the pixel distribution of the form both horizontally and vertically.

Step 6: Trimming black borders at the bottom of the pixel distribution watershed.

Step 7: Sort and filter sub-images and get target drawings.

**Result:** Eight single drawings from each questionnaire form.

In this thesis, space utilization, animate and inanimate, the numerical order of sequence, the ratio of straight lines and curved lines and category classification are selected which is shown below images.

Space Utilization

animate and inanimate

NOS: 12345678   NOS: 87654321

NOS: 12348765   NOS: 87651234
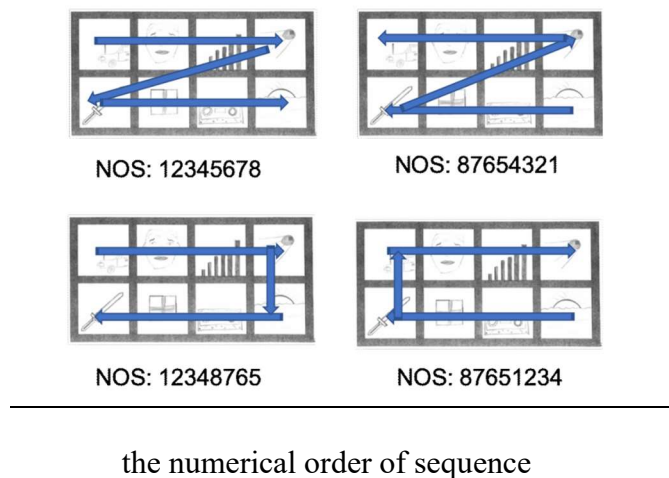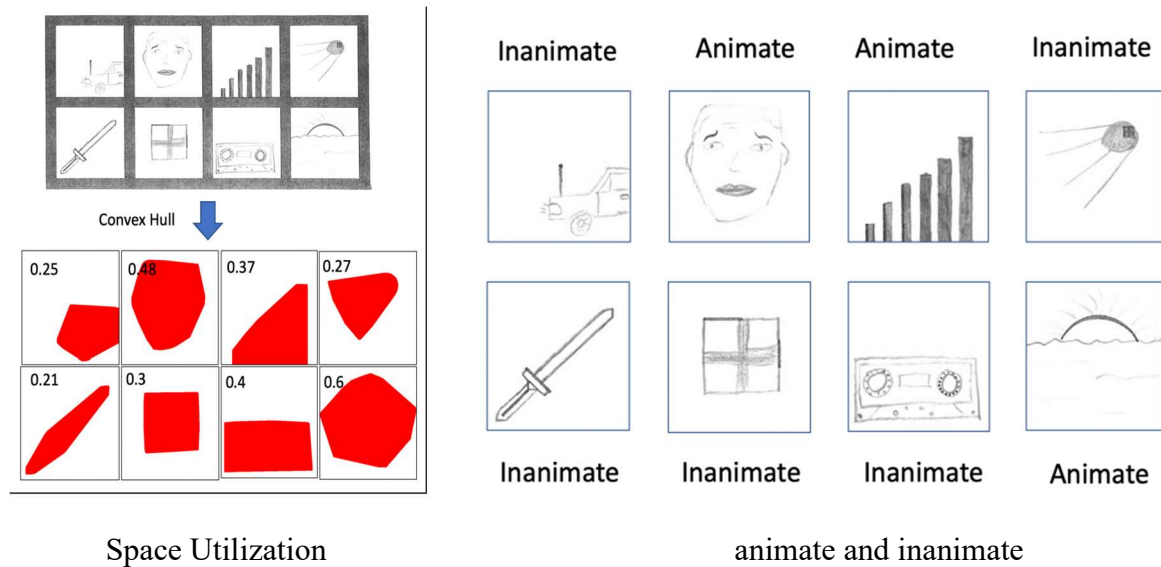
the numerical order of sequence

Once this process is completed, Training on inception is required. In the below diagram it shows the process of computer-aided and training dataset where training on inception takes place. Once extract features and sketch model are completed then based on the algorithm a final sketch classification result will be generated.
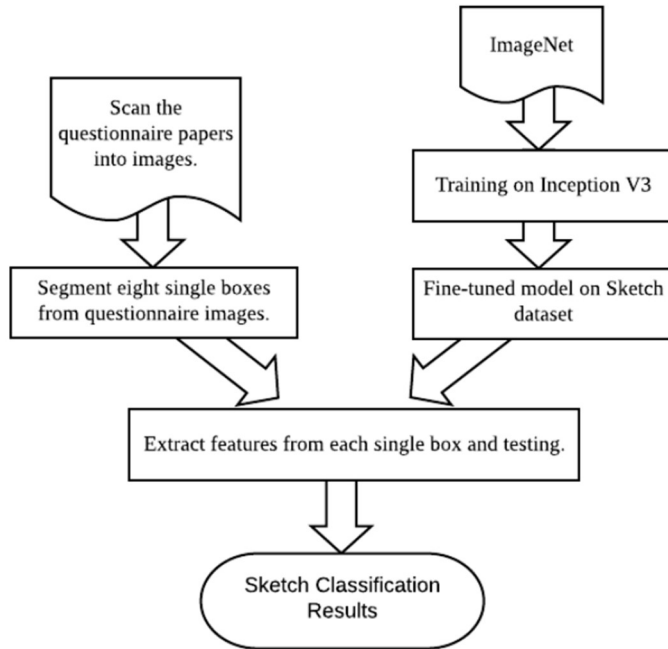
In this thesis, Micro F1 is used to split the number of classes, TP (True Positive), FP (False Negative) and RN. In the below result table shows the result of Sketch dataset.\

Methods	Datasets	Results
Human [48][49]	TUBerlin	73.1%
Resnet [41]	TUBerlin	77.1%
VGGnet [38]	TUBerlin	78.93%
SketchNet [50]	TUBerlin	80.42%
Inception-V3 [51]	TUBerlin	91.89%
Transfer Learning Inception-V3	**TUBerlin+Quick Draw**	**94% (Top5: 98%)**

The F1 score is calculated by the rate is micro Where recall is calculated by the (TP÷(TP+FN)) *100 %, Precision is calculated by the (TP÷(TP+FP)) *100 % and F1-score is calculated by the ((2 Precision Recall) ÷ (Precision + Recall)) * 100 %.

The result shows 94% and 98% for top-1 and top-5 classification results.

Inception V3 is used in this experiment for neural network classifier where transferred and fine-tuned model to Wartegg data. From the 10 objects to 176 over 80% included the response from user and classification for 176 types of data is 63% for top-5 result. The best result which balances the performance with 176 is 63%. This is obtained based on two stage transfer method.

Technical contributions for case study 2:

In this case study. I will discuss about the Wartegg Test in different countries and future work.

Wartegg Test in Finland:

The first serious experiment was conducted in Finland by Takala and Hakkarainen. Both psychologists conducted researched on 1025 subject to have better result of Wartegg Test. The scores of the drawing test were studied regarding to relation of age, intelligence, interest, and personality traits. Another valid study was conducted by Roivainen and Ruuska in which a low negative correlation (-0.33) was found. Result says that efforts to develop the methods towards meeting empirical validity and reliability should be conducted.

Wartegg Test in Brazil:

In Brazil, Wartegg test is more popular and generally used to test the personality. It was found that 20 out of 34 companies using Wartegg test in their recruitment process. Based on 1,020 cases, Freitas (1993) identified popular and unusual responses in Brazilian Wartegg drawings. interpretation guidelines suggested by Freitas were, for the most part, not confirmed in a validation study. However, some positive correlations have been observed by Souza, Primi, and Miguel (2007). There was a correlation between PF 16 scores and Wartegg test drawings. For example, inhibited Individuals with a low PF 16 A score produced less curvilinear drawings than the group with a higher score on scale A (r= -0,24, p=0.008) was predicted by Freitas. In 2003, the Brazilian psychological association (CFP, 2003) issued a statement. The use of non-validated tests in assessment should be considered cautiously. According to et al., the Wartegg test does not yet meet the requirements. Tests that have been validated should be included in the CFP.

CONCLUSION AND FUTURE WORK

The Experiments conducted in two case studies shows the effective results. In case study 1 helps to understand the computer-aided system which have capabilities to perform Wartegg test by web-based system. By using artificial neural networks help to make such system which recognizes the hand-drawn and convert it into the system-based drawing. In the beginning, Yunqi Xu, the speaker discussed about the object detection and specially Yolo for object detection method.

Future extension of system takes place by:

1. Feature extension in system: Its possible to add additional features to the system. New features like carefulness (how tester drawn the strokes), Nice or ugly drawings 45 ratio. Meaningful or meaningless responses. Direction of each drawing. If system has this feature, it will be enhancing the system to provide more accurate results.
2. Multi label sketch detection: In the current experiment only, detection was took place but it is possible to add scenario where multi object detection capture. Its better to create such algorithm which capture multi-sketch.
3. Color the sketch with generative models: The image which has color looks interesting and creative. This task will be challenging for training the model for image coloring because it may be landscape coloring, cartoon coloring and others sketch coloring as well.
   For Wartegg test data, its possible to add color on drawing based on the psychology description.

   I'm looking forward to updating these features in the future work which enhances the quality of the system.

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   https://spectrum.library.concordia.ca/id/eprint/987782/1/Liu_MSc_F2020.pdf
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   https://www.ibm.com/cloud/learn/neural-networks
4. Image of object detection vs image recognition, types of object detection retrieved from
   https://www.v7labs.com/blog/object-detection-guide