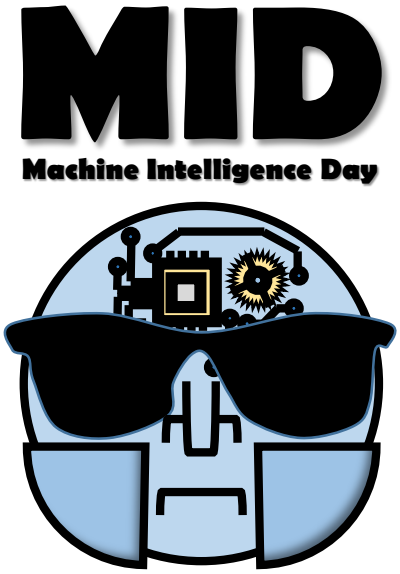
Proceedings of

Machine Intelligence Day

December 6 2019



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Poster Session

Preface

We are very pleased to have the opportunity to organize the first Machine Intelligence Day 2019. This conference is sponsored and hosted by the Seidenberg School of Computer Science and Information Systems at Pace University. Machine Intelligence Day is an annual New York based conference hosted by Seidenberg School of Computer Science and Information Systems at Pace University. It occupies a unique place among conferences, presenting both new research and exceptional student papers, providing opportunities for both faculty and student participation. The purpose of Machine Intelligence Days is to provide a learning and sharing experience on recent developments in Artificial Intelligence, Computer Vision, Data Mining, Machine Learning, and Pattern Recognition. The conference is welcoming to a range of participants, open to both researchers in the field and students. While experts give talks, they are targeted at audiences in general computer science with an eye dedicated towards students.

Five faculty member speakers, Dr. Sukun Li, Professor Juan Shan, and Professor Charles C. Tappert as well as two co-editors, have contributed to the conference. Six current doctorate student speakers include Krishna Bathula, Carmine Guida, Kaleemunnisa Lnu, Dong Lu, Yu Lu, and Xiaodong Xu. Two graduate student speakers include Ian Carvalho and Leonard Marino. We are grateful to them. Ten abstracts were selected for poster presentations.

We have strived to publish well-written abstracts that present important original research results and/or open problems relevant to Machine Intelligence. We received over 30 abstracts and carefully selected 5 faculty member presentations, 8 student presentations, and 10 poster presentations. We would like to express our gratitude to all the contributors and participants. Finally, we hope that you will benefit from this conference and its proceedings.

S.-H. Cha and P. D. Benjamin

Future of Brain-Computer Interaction with Machine Learning

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As a frontier research *brain-computer interface* (BCI) has attracted great interest in both scientists and technical fields. The brain-computer interface establishes a direct communication protocol between the human brain and external devices. It can infer user intent via real-time measures of the *central nervous system* (CNS) activity and thus enable the human-computer interactions without physical activities. One of the most potential CNS measurements for the applicable BCIs is *electroencephalographic* (EEG), which recorded the signals from the scalp with user-friendly non-invasive sensors.

The characteristic of EEG-based BCIs is well suited for machine learning. Machine learning is an effective tool for interpretation of the resulting large-scale and diverse EEG data from the interactions between human brain and computers, and the technology can provide automated methods for identifying and exploiting those regularities. Although the BCI devices are rapidly evolving to become widely available, the challenges for decoding human brain actives and recognizing the user's intentions by using EEG signals are still existing. Those challenges can be explored from the terms of the acquisition, feature space, distinctiveness, and accuracy. This presentation seeks to give an overview development trend for the brain-computer interaction with machine learning, and also highlight several research tracks that we have done and are working at the Seidenberg School of CSIS and other universities.

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Deep Learning Models for Medical Image Analysis

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With the rapid domination in the traditional computer vision domains, deep learning, in particular, convolutional neural network (CNN), has been successfully applied in many aspects of medical image analysis, including image classification, object detection, segmentation, registration, and other tasks. In this abstract, we discussed three applications of CNN on different medical problems.

Ultrasound breast tumor segmentation has been a challenging task because of the low-contrast and inherent speckle noise of ultrasound images. Traditional segmentation methods are usually semi-automatic or depend on manual parameter tuning heavily if fully automatic. They are less portable when transferring from one database to another. When applying DL algorithm U-net to this task, we found that the model can adjust itself automatically with precise segmentation result, requiring hardly any parameter tuning. Whats more, it can easily adapt to a different dataset through transfer learning. The comparison of U-net with two traditional fully automatic segmentation methods shows that U-net outperforms the other methods significantly on the same dataset (DICE 0.82 vs. 0.62 and 0.57).

Encouraged by the ultrasound image segmentation result, we further applied U-net model on 3D knee MRI images for bone segmentation. Bone structures are important in knee MRI since they interact with all other tissues and structures. Accurate identification of the bone boundary can facilitate the detection of many other tiny biomarkers, which could be more challenging if identified directly. In this application, we modified the U-net model to take multiple input channels instead of one. Neighboring slices in the 3D sequence are fed into the model with the center slice for a better segmentation result. We have experimented with different numbers of neighboring slices and the result shows that with four neighboring slices the performance is best. The evaluation metric DICE is improved from 0.96 to 0.97, by increasing the input channel from one to four.

The third application is a cell stage classification problem using microscopy images. Cell division time is an important indicator to select healthy embryo during the in-vitro fertilization (IVF) treatment. Given the huge amount of images generated through the embryo development process, it is very time-consuming to manually screen these images. We have designed an automatic algorithm to count the number of cells in the image sequence. Through counting the number of cells, the algorithm can identify the cell division spot when the number of cells changes, and therefore, calculate the cell division times from one cell to eight cells. DL algorithm Inception V3 was adopted to classify the cell images into eight categories, with category N corresponding to images with N cells. With the huge training dataset (a total of 661,062 labeled images) and the powerful DL model, we achieved an average classification accuracy of 0.94 within five frames up to 8-cell stage.

In conclusion, deep learning algorithms could be used to solve many medical image analysis problems. They provide a solid step to bring us closer to ultimate goal for medical image analysis with high accuracy, low cost, fully-automatic and reliable computer-aided systems.

Topics in Dichotomy Transformation Model for Biometric Systems

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Twenty years ago, the dichomy transformation model (DTM) was first proposed in to establish the individuality of biometrics [1]. While the simple match model has univariate distance values, the DTM has multivariate distance values, as illustrated in left side and right sides of Figure , respectively. One natural advantage of the DTM is that it allows to combine multiple classifiers and handle heterogeneous features [2]. Here research topics regarding DTM are presented. The first obvious one is to combine multiple versifiers using the dichotomy model for certain biometric. Second, the within and between class distribution seem to follow multivariate log-normal distributions. The study of these two distributions for better statistical inferences is of great importance. Next, while the vector representation is a typical pattern representation in most machine learning applications, innovative pattern representation and its suitable proximity measure between patterns can be naturally integrated into DTM. Finally, geometrical aspects of DTM allows to determine the upper limit number of subjects that can be distinguished by a given biometric versifier. Further studies on geometrical aspects are necessary.

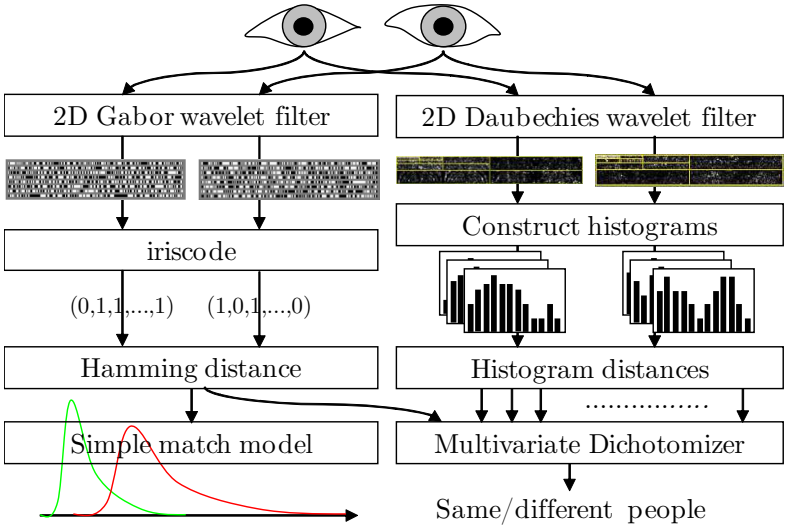

Figure 1: Simple match model and dichotomy transformation model.

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Spatial Understanding as a Common Basis for Human-Robot Collaboration

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The goal of our project is to create a robot that can interact with people safely and effectively. We are focusing on understanding nonverbal behaviors, because much of the interaction in the real world is nonverbal. It is not possible for people to continually explain their movements to the robots; the robots must be able to generate their own explanations. Our approach to this problem is to apply goal-directed reasoning to perception. The robot first decides which aspects of its environment are most likely to be relevant to its task. This information is used to focus the cameras on specific regions of the environment and extract only the types of information needed to understand the environment.

Identifying Relevant Questions Regarding Laboratory Tests from Community Question Answering Websites

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As the easy access of clinical data in patient portals does not guarantee patient better understand their health status, patients grow confusions and can hardly act upon the clinical data presented to them [1, 2]. As a result, they turn to online resources to make sense of their clinical data and to seek support in making better clinical decisions. Among various online platforms, community question-answering (CQA) websites have been widely used due to their interactivity and popularity. However, to date, prior work have not investigate how to support retrieving relevant medical questions concerned by the pre-pregnant, pregnant and post-pregnant population. Yet retrieving relevant questions of these populations is important, because pregnancy concerns a wide range of factors in healthcare, such as patient-doctor communication, clinical laboratory test, clinical decision-making, and medication. To address this research gap, we propose a system consisting multi-level vector representations of text, and domain-specific biomedical ontologies tailored towards the pre-pregnant, pregnant, and post-pregnant populations. The multi-level text representations include traditional Bag-of-Words (BoW) text representation TF-IDF, the deep contextualized word embeddings ELMo, and the sentence-level embedding Universal Sentence Encoder (USE). The system is tested using questions posted on Yahoo! Answers pregnancy subsection of the health section between 2009 and 2014. Specifically, we investigate how the implementation of the domain-specific biomedical ontologies can enhance the retrieval of the relevant medical questions concerned by the our targeted users. Human annotation of the Yahoo! Answers dataset will be used as ground truth to compare the ranked results of the system.

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Cartilage Segmentation for Knee MRI Images

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This study introduces a new method for automatic knee cartilage segmentation using Deep Neural Networks. It has clinical relevance in both diagnosis and treatment of osteoarthritis. Deep Neural Networks have been applied successfully to segmentation tasks and show promising results in the medical images. One of the challenges of segmenting the knee cartilage is the Deep Segmentation Networks tend to ignore smaller objects during the learning phase[1]. To address that challenge, a Gated Shape Convolutional Neural Network (GSCNN) was chosen for this study. This architecture tends to produce sharper predictions around object boundaries and increased the performance on thinner or smaller objects when applied to other segmentation task [2].

In order to evaluate the performance of GSCNN in the knee cartilage segmentation task, the experiments were performed on the SKI10 dataset. The SKI10 detasets consist of 100 knee MRI volumes, being 60 for training and 40 for evaluation, containing sagittal, coronal and axial planes.

For the classification task, two models were trained one for segment the bone-cartilage-complex (BCC) and one for bone only segmentation and for evaluation the cartilage mask was obtained by calculating the bone-BCC-difference (BCD). This approach has shown to provide better performance compared to methods that segmented only the cartilage directly [1].

Table 1: Quantitative results for knee cartilage segmentation on SKI10

Method	TC	FC
BCD-Net	83.8	**98.1**
U-Net	72.3	79.5
GSCNN Cartilage Only	81.2	83.9
BCD-GSCNN	**85.3**	89.6

The results were then compared with U-Net[3], a popular architecture for medical imaging segmentation tasks, BCD-Net and GSCNN with cartilage only information. As shown in Table 1, using BCD with GSCNN improved its performance and achieve state-of-the-art results for both Tibia Cartilage (TC) and Femur Cartlage (FC) segmentation.

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Automated Detection of Knee Osteoarthritis Severity Level Using 3D Convolutional Neural Networks

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Osteoarthritis is the most common form of arthritis and can often occur in the knee. Convolutional neural networks (CNNs) have become a popular method for prediction and classification problems involving medical images. The following study explored using a 3D CNN model to fully automate the classification of knee osteoarthritis severity level. An advantage of using a 3D CNN is the ability to analyze a set of images as a single unit as opposed to a traditional CNN which examines one image at a time. The model (Figure 1) developed for this study is based on a 3D CNN model for predicting total knee replacement [1]. The dataset for this study, contained MR images of 98 patients (29 with OA and 69 without OA) each with a set of 160 images forming a 3D matrix of the knee. We have experimented with different strategies to reduce the dimensionality of the input data and tune the structure of the network which shows consistent improvement of the accuracy. As a pilot study, we are able to achieve comparable performance to a recent state-of-the-art study [2] (F-measure 0.70 vs. 0.71) on the same dataset, while our method is fully automated and does not require any features through manual labeling. We plan to further tune the model structure and fuse multiple models to improve the accuracy.

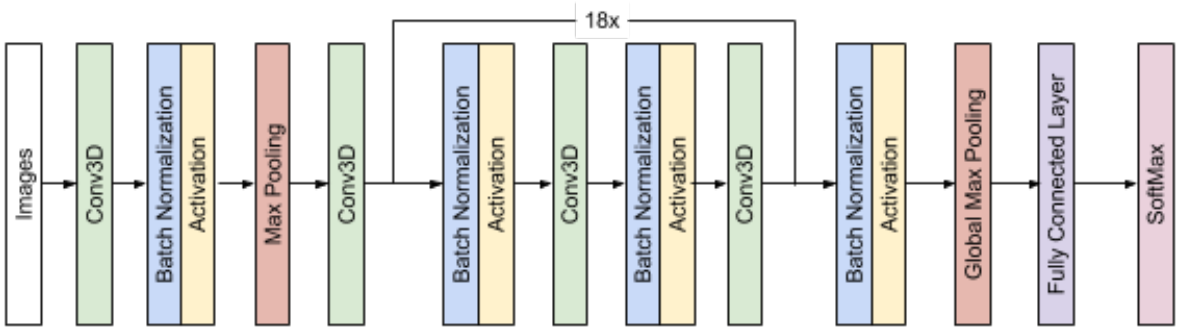

Figure 1: 3D CNN Model.

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Hairline Fracture Detection by Generative Adveserial Network

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The hairline fractures are mostly minor cracks developed in the human skeletal system or bones. These are most common and tend to occur due to the exertions, majorly caused by the activities such as sports, accidents and aggravated movements. As these cracks developed are minor in nature, they are hardly visible to the human eye and seldom it is a challenging task for the doctors to predict if a fracture is present Fig [1]. Even if the prediction is positive, it is rather difficult to understand if a surgically invasive procedure is necessary to heal it. The diagnosis is left with much of ambiguity to deal with.

To combat this problem of visibly identifying the undetected cracks, pre-processing the medical image is essentially vital. The process can then be followed with using the Generative Adversarial Network(GAN) model which can be trained to generate images from noises that are present in the images. GAN has two components, the generator which generates the images and the other discriminator that can distinguish and classify the actual and fake images. The generator is a Convolutional Neural Network (CNN) and the discriminator is a Deconvolutional Neural Network (DNN). Both compete with one another to enhance the image properties and reduce the noise considerably.

There are two main methods in the application of GAN in medical imaging. First one comprises of using Generative characteristics, which helps in the identifying primary features of the training dataset and learn to generate new enriched image without losing the original features aspects. Second emphasizes on the discriminator where it is considered as trained prior for normal images and it can relate to the actual image and discriminate any abnormal images [1]

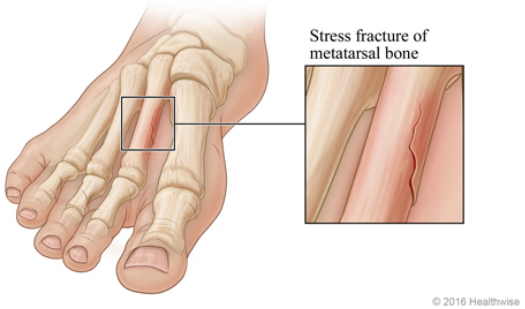

Figure 1: Depiction of Stress or Hairline Fracture.

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Music Stimuli for EEG-based User Authentication

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Electroencephalography (EEG) has emerged as a successful and secure option for user authentication. As a biometric, brain signals contain highly unique "distinctive features" [1] that carry user discriminating information which are difficult to steal or mimic [2]. However, the majority of previous studies conducted only use visual based stimuli to evoke a response from subjects, while using music as the EEG stimuli for brain activity authentication is rarely considered. In this study, we attempt to fill that gap with a new framework for user authentication using music stimuli.

During this research, the EEG signals of 16 healthy subjects were collected once a week for multiple weeks. Each week, participants completed a single 5-minute session composed of 60 seconds of rest, 60 seconds of classical (M1) music, 30 seconds of rest, 60 seconds of jazz (M2) music, 30 seconds of rest, and 60 seconds of electronic (M3) music. Eight channels were chosen for analysis, six were selected for their proximity to the auditory cortices, with two additional channels placed in the frontal and occipital areas. For feature extraction, a dynamic histogram measurement model with segmentation (DHMS) [3] was used. The DHMS is a high-quality feature extraction method for estimating the energy distribution of a signal across the time-frequency domain. The signals were segmented into 10 second frames with 75% overlap. These feature vectors then underwent dichotomy transformation [4] to turn this multi-class classification problem into a binary-class classification problem for the purpose of user verification. The resulting 'feature-distance domain' is used to train a Support Vector Machine (SVM), with a linear kernel. The best accuracy rate achieved was 95.27%, with an overall mean accuracy of 90.02%; 27.87% higher than those achieved with a conventional statistical feature extraction model. These results show that EEG signals collected under musical stimulation carry user discriminating features and further establish the efficacy of the DHMS feature extraction method.

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Use of Game theory in EEG Channel Selection

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Electroencephalography (EEG) signals are recordings of brains electrical activity gathered from the scalp and is commonly used and analyzed in healthcare, human-computer interaction, etc. Electrodes are used to gather EEG signals and the International 10-20 system standardized by International Federation of Societies for Electroencephalography and Clinical Neurophysiology (IFSECN) contains 21 locations [1]. Given the nature of how signals are gathered, they tend to be multiple channels [2]. Benefits of working with a subset of channels rather than all of them are obvious, e.g. less monetary (less electrodes needed) and computational (less data processed) costs, more relevant feature extraction, and so on. In [3], authors demonstrated that comparable performance can be achieved with 6 or 8 channels instead of all 32 of them. Certainly, channels can be selected based on past knowledge or by experts. We recast the channel selection process as a feature selection problem in hope of revealing new information about brain activities. Feature selection algorithm is heuristic search based on search strategies, selection and stopping criteria and tries to find the most discriminative feature subset. This is in essence very similar to channel selection. While algorithms can be easily adopted for channel selection purposes, the interrelationship between channels should be emphasized given the nature of EEG signals. We intend to discover channels may have weak performance as individual but collectively perform much better. For this reason, we introduce cooperative game theory. A cooperative or coalitional game is defined as a game with players forming groups to compete. It is often analyzed based on coalition formation, possible joint actions and collective payoffs. Here we extend models in [4] to solve this problem. Each channel is firstly evaluated based on Banzhaf power index. Banzhaf power index measures the voting power of each player in a game by counting the number of times a player is a critical voter, i.e. a coalition fails to meet winning criteria if this player leaves the coalition. Then a general feature selection scheme is applied with adjusted weights based on features Banzhaf power indices. Like how feature selection schemes interact with learning algorithms, we expect classification or other learning algorithms used later in the process can affect our choice of the feature selection method.

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Implementing and Accelerating Match-Mediated Difference Algorithm by GPU

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Robots moving in a dynamic world need to be able to predict the motions of people and other robots. We describe a system for modeling the real world in a virtual world, and show how the virtual model can be updated in real time by detecting differences between it and the real world.In this paper, we focus on Match-mediated Difference algorithm (MMD) model [1].

We have implemented and accelerated the Match-mediated Difference algorithm (MMD) on GPU and also applied this algorithm to track the differences in video.Firstly, we processed a single image using MMD on GPU by launching 240*320 threads (240 blocks * 320threads/block). Then, we simulated the real-time video to process the video using MMD on GPU. Also, the video processing is applied by openMP [2] parallel computing. The video processing is accelerated by a factor of 5. Finally, we show how the MMD algorithm filter the differences in order to reduce some details we do not need. Meanwhile, we label the center coordinates of difference areas.

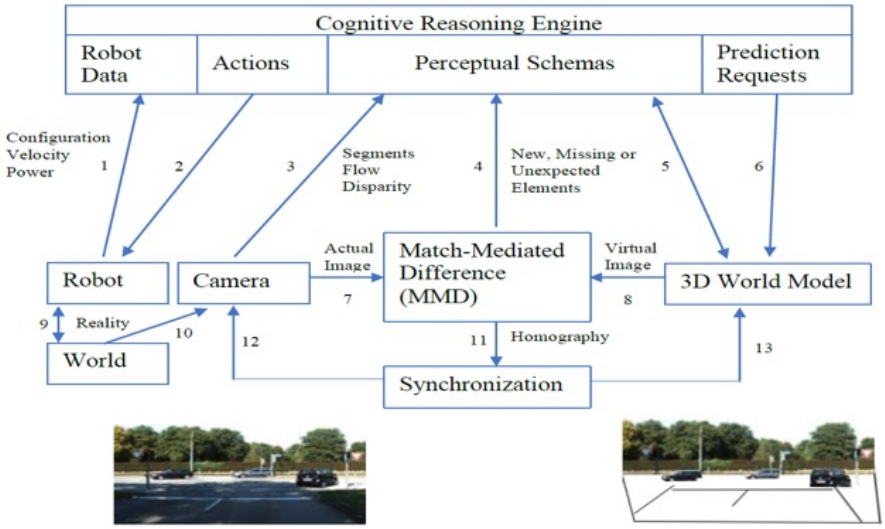

Figure 1: System Diagram of ADAPT(Adaptive Dynamics and Active Perception for Thought).

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Text Classification with Context Model Using Deep Learning

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This research study is based on the idea of classifying text with context model. The model refers to the type of context that text is embedded with. This genuinely checks if the text is relevant to the topic that is been referred to. Context can be further classified as local and global. The deep learning model can be used either for prediction or classification [1]. This study is aimed at classifying the text data, and this is a binary classification. Due to large amount of text data which is growing exponentially,with the growth in social media, e-commerce, online news, reviews as per [2]. Using this model we can expose the inaccuracy of the text data and find the authenticity and relativity which is the novelty in this model. One of the crucial task while dealing with text data is data pre-processing or data cleansing, where removal of irrelevant, superfluous text features takes place, like punctuation's and stop-words. This help in reducing dimensions of the future space, which can improve the accuracy of learning model. As Machine Learning model takes array of numbers instead of text, so we need to convert the text into numbers, and this process is called vectorization . There are different approaches to vectorization, in this study Word Embeddings is used. The data set is private which has 12,000 reviews from different e-commerce sites. These are split for training and testing. These sets are balanced and have equal amount of relevant and irrelevant text reviews.

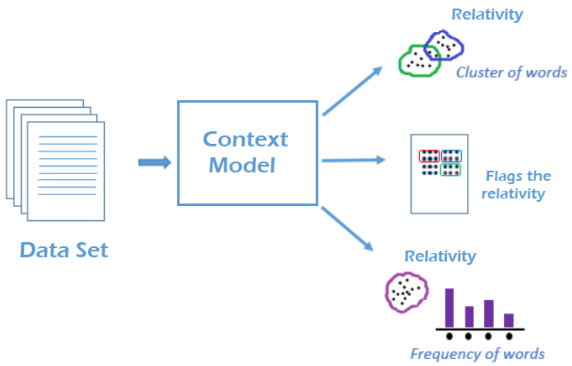

Figure 1: Model

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A Parameter-Based Computational Model for Long-Term Episodic Memory

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Substantial progress has been made to understand the functioning of the human brain from a computational perspective. For example, deep leaning has made revolutionary advances in recent years, especially in image and speech recognition, to approach human sensory capability. However, little progress has been made towards understanding other brain activity such as memory storage and recall. This study develops a parameter-based computational model of long-term declarative episodic memory to extend Rosenblatt's proposed "clock-memory" model by using deep learning networks with a novel one-shot learning algorithm. One-shot learning is important because the human brain learns fast from one or a few examples unlike most deep learning networks which require a massive number of examples to learn simple things. Experiments were conducted using the MNIST, CFAR100, Fashion MNIST, and A-Z datasets to show that the memory model can recall lifetime sequences of input images.

In summary, the major contributions of this research were:

- Design and analysis of a parameter-based computational model of long-term episodic memory.
- Creation of a unique one-shot training algorithm for the clock memory of the system that not only provides adequate memory recall over a human lifetime but also demonstrates decreased memory recall for events as they recede into the past.
- Discovery of a method of estimating the memory recall accuracy for various parameter settings over a human lifespan.
- Experiments conducted on a variety of popular image databases to show that the model is not database dependent.

This is a summary of a PhD dissertation by Yousef Alhwaiti (advisor Dr. Tappert), and was presented at the Symposium on Artificial Intelligence (CSCI-ISAI), Dec 2019.

A New Ensemble Method for Convolution Neural Networks and its Application to Plant Disease Detection

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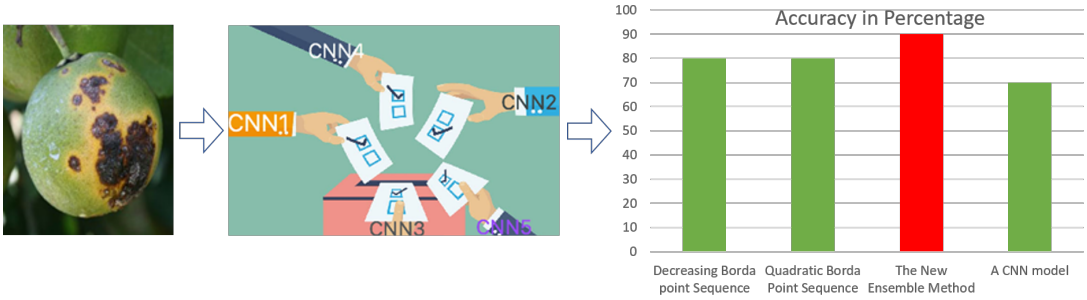
Agricultural demands are multiplying at an alarming rate directly in proportion to the increasing population. However, the supply graph can almost be computed inversely. Unpredictable weather change and disease along with addedfactors cause massive yield reduction during preandpost-harvest periods. Non-implementation of modern technology is a contributing factor to low yield.This paper is concerned with a new approach to identify plant contamination adopting methodologies to perform image processing and arriving at a near precise decision taking into consideration, the ballot of all models. The purpose is to promote crop yield with the assistance of Artificial Intelligence as a tool to identify crop diseases after an image has been inspected bya score ofmachine learning models and the final decision is arrived uponby applying Preferential voting method.In this research, a total of 20 models were first built with different architecture each using components that have been designed precisely with non-recurring configurations with the aim to achieve maximum accuracy. The developed models are able to recognize 7 different types of plant diseases out of infected plants.Infusion of modern technical practices in farm sector can maximize productivity. It is important to enable farmers to move fromconventionalgray era methodsto tech-driven farming that requires changes in cultivation, harvesting and adoptingnew technologies. With the ability to preserve the crop by precisely identifying a crop disease, agricultural production can be enhanced byaconsiderable percentage. The intelligence of amalgamating CNN with a voting algorithm is an affirming method for agricultural supply to meet with the elevated demand due to exponentially increasing population.



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Linear Representation of Human Movement in Images

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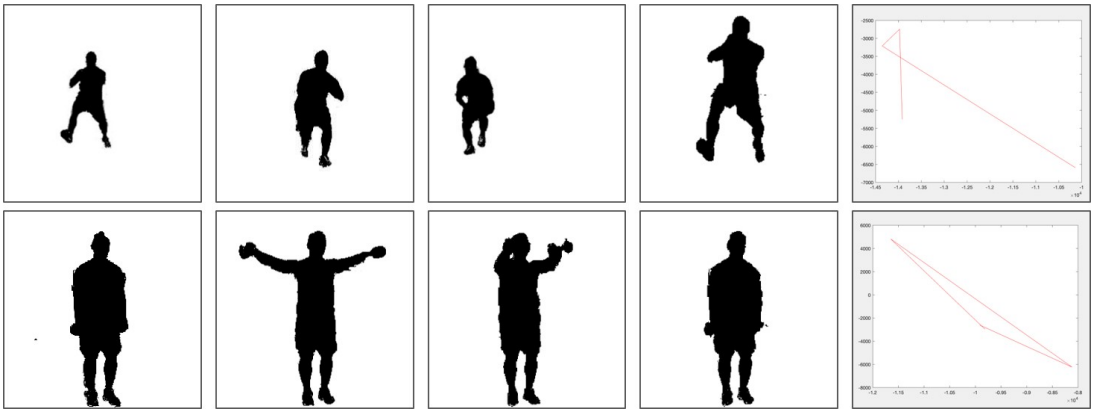
This researchexplores solutionsfor how tobestrepresent a series of images that define a movementon a linear plane. The experiment was conducted on images of bodybuilding exercise instructionswhere each exercise contains four consecutive images, and each image is a pose within the movement of the exercise. Through image segmentation we were able to separate the human body from the image andthencalculate 17geometric measurementsin order to identify and detail the human bodys shape. By first using the 17 geometric measurements asfeatures to represent each individual pose as a vector, we were ableto represent the poseon a linearplane by using Principal Components Analysis(PCA)on each vectorand then combine each pose based on its associated exercise. By doing so we were able to trace each exercises movement as a line plot. An excellent use case for this approach would be for exercise form coaching, where a professionals movement is recorded, and a novice bodybuilders movement is tracked and compared to the professionals movement in this representation in order to perfect the novices own movement with automated feedback. In future work we believe this representation can be expanded to various types of movements besides bodybuilding by using different approaches to deriving low-dimensional features from larger sets of features. For instance, an Olympic fencing player could use this model to compare his/her pose with former medalistsfor further improvement. Also, different approaches could be utilized beyond CPA based on the number of vectors derived from the image object.



Machine Learning Analysis of Mortgage Credit Risk

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In 2008, the US experienced the worst financial crisis since the Great Depression of the 1930s. The 2008 recession was fueled by poorly underwritten mortgages in which a high percentage of less-credit-worthy borrowers defaulted on their mortgage payments. Although the market has recovered from that collapse, we must avoid the pitfalls of another market meltdown. Greed and overzealous assumptions fueled that crisis and it is imperative that bank underwriters properly assess risks with the assistance of the latest technologies. In this paper, machine learning techniques are utilized to predict the approval or denial of mortgage applicants using predicted risks due to external factors. The mortgage decision is determined by a two-tier machine learning model that examines micro and macro risk exposures. In addition, a comparative analysis on approved and declined credit decisions was performed using logistic regression, random forest, adaboost, and deep learning. Throughout this paper multiple models are tested with different machine learning algorithms, but time is the key driver for the final candidate model decision. The results of this study are fascinating and we believe that this technology will offer a unique perspective and add value to banking risk models to reduce mortgage default percentages.

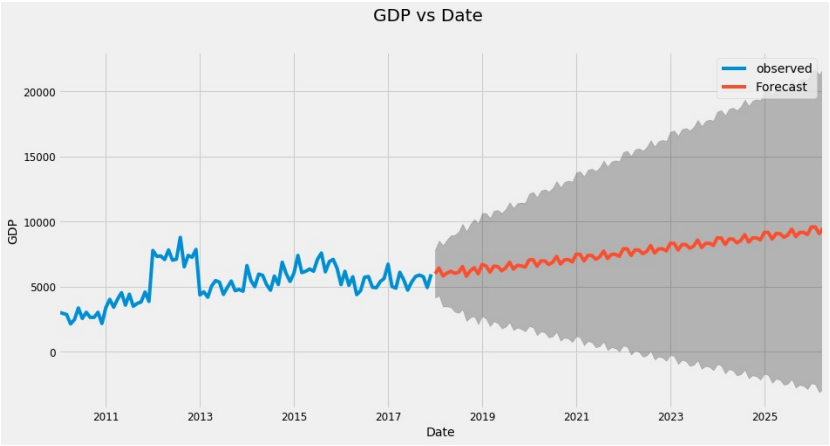

Figure 1: GDP vs Date for NY State, prediction from 2010 to 2017, forecast from 2018 onwards

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Evaluating Statistical Parameters for Bird Sound Recognition

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Evaluating the effectiveness of the bird sound identification in a situation that emulates a realistic, typical application. Identification has been made using classifiers- kNN(K Nearest Neighbour) and SVM(Support Vector Machine). The system has been tested using data extracted from natural environment. The system has been tested using data extracted from the natural environment. Recognition is done based on the parametric representation of the sound events by comparing those with the models of sounds produced by species in the recognition experiment. Features should be selected so that they are able to maximally distinguish sounds that are produced by different bird species.

Figure 1: Bird Sound Detection.

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An Efficient Cloud Detection Algorithm based on CNN using TensorFlow

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The significance of cloud detection in the areas of remote sensing and image processing is highly considered. Existing systems use basic methodologies to detect which can therefore produce erroneous result when it comes to complicated and complex clouds [1, 2]. Therefore, to address this problem, a novel cloud detection system using deep learning-based algorithm is developed. This algorithm consists of a Convolutional Neural Network that is trained by SWIMSEG (Singapore Whole Imaging Datasets) images. Our model will predict and classify the type of cloud formation, which can be utilized for weather prediction.

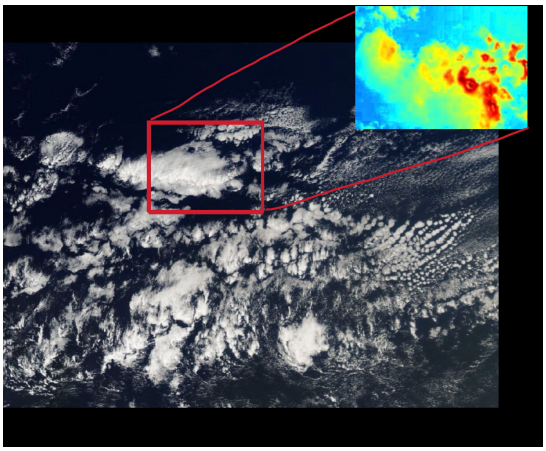

Figure 1: Cloud Detection

References

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Automatic Data Partitioning Algorithm for Multiple Linear Regression

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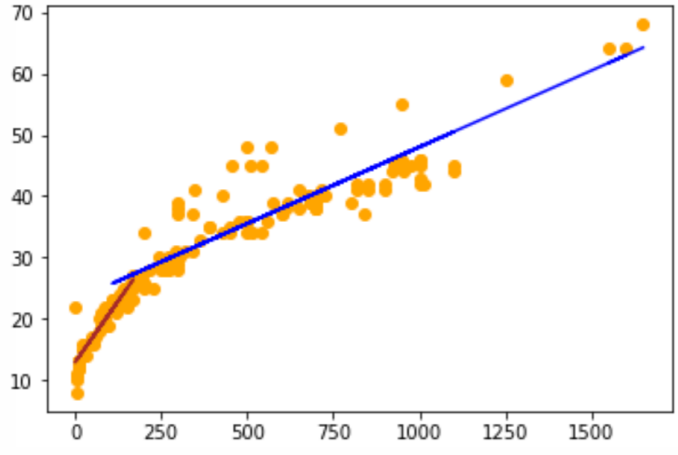
Data can be of any shape and size, it can be skewed, or it can be straight. To build a single linear model for a skewed dataset would result in loss of accuracy and more penalty from the data points which are away from the predicted line due to the skewness of the dataset. For this proposed problem we suggest a hypothesis of the concept which partitions the data based on their skewness and build multiple linear models for the respective partitions. The proposed algorithm partitions the data smartly without human intervention considering the slope as the fundamental principal to create partitions. So, we can now go through the following step to achieve the partitions.

1. Try to partition the training data based on certain threshold implied on the Y-axis.
2. Start measuring the slope from the minimum data point with every other data point in the same partition as well as in the next consecutive partition
3. Recording the average slope for each respected partition.
4. If the slope of the next partition is greater than the half of the previous partition slope, then re-initialize the minimum data point to the next partition minimum point.
5. Repeat the process again from step 2 for further partition of data.



Expressing Tweet Emotion as Emoji, and Detecting Violence

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Nowadays Emoji are a substantial part of our social media and instant messaging communication, with more and more words becoming substituted by emoji characters. They have also been studied as a means to effectively express tweet emotion [1]. Emoji are semiotic objects as they demonstrate a multitude of linguistic semiotic layers and can be interpreted as signs, metaphors, analogies or symbols [2]. These observations solidify emojis as a powerful tool for representing text and emotion in creative ways.

In this research project we analyze the emotion of tweets written in the English language, offering the emoji as a complementary representation of the tweet content. Our dataset was built using Tweepy, pandas, and the Python programming language. All tweets are in English and include a mix between recent and popular content. Natural Language Toolkit (NLTK) was used to clean up the tweet text and tokenize the text corpus. Latent Dirichlet Allocation (LDA) was used for topic modeling, classifying the tweets into four emotions: joy, sadness, fear, and anger. Each emotion is represented by its emoji equivalent (see Figure 1). We further analyzed our tweet data to detect for potential violence.

Tweet (real examples)	**Predicted Emotion (represented in Emoji)**
"took my toungue ring out today and im sad,i miss it already 😩 "	😢
"Im glad the raptors humbled the shit outta the lakers they were getting too happy for my liking"	😂
"The way im upset, id have to stay away from this app bc the more i see tweets about it, the more angry i get"	😠
"just saw kny spoilers of tanjiro ****** ** *** and now im too scared to read the new chapters"	😨

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EEG Based Gender Classification

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The objective of our paper is to find out if we can classify people based on their gender using electroencephalogram data. We collect data from 10 subjects when they are in relaxed state. That is useful in building automatic systems that classify a person into gender or age groups based on EEG characteristics of that person, index EEG data for searching, identify or verify a person, and improve performance of brain-computer interface systems. We extracted the feature statistically and we used SVM classification method in this procedure.

Index of Participants

CC - Conference Co-Chairs PC - Program Committee LA - Local Arrangement SV - Student Volunteer