Preliminary Research Interest Report

Submitted to,

Dr. Nitin Agarwal,

*Jerry L. Maulden-Entergy Endowed Chair and Distinguished Professor of Information Science at UA Little Rock and Director of the Collaboratorium for Social Media and Online Behavioral Studies (COSMOS)*



Rick Rejeleene,

(1st year) PhD Information Science

University of Arkansas, Little Rock

*Based on my survey and understanding so far:*

* the core problem of Reinforcement Learning is to make an optimal decision using an agent in an environment
* In social media, one could model the environment through reinforcement learning, my rough idea is that an agents would be accounts or users, with various actions activities such as like, retweet, engagement, news dissemination, meanwhile optimal policy would be maximum goal-oriented outcome of a defined problem

Within Social Media, unexplored application areas of applied Reinforcement Learning seem to be:

-Web Crawler

-Fake-News detection using Reinforcement Learning

-Narratives

-Agent based model

-Social Bot in NewsFeed, Chat rooms

-Social Intelligence in Social computing [learning context, reacting to human behavior]

-Web Task Automation [Flagging Fake News, Flagging Abuse, Responding to Human queries for abuse]

**Research Questions:**

I am wondering for my research direction, I have come up with interesting preliminary questions that you would be able to direct me better. I do not think it is complete but my simple attempt to think of direction. I am sure you can help me concise, narrow down these.

1. Can a web crawler (BlogTrackers) by using Reinforcement Learning gain skills to detect, malicious actors online? When I think of skills, I think in this context, skills relevant in detecting propaganda, misinformation, disinformation.
2. Survey paper of Reinforcement Learning applied in Social Media applied within Information Science discipline. I did not see any survey paper intersecting both areas. The Survey paper is mostly focused on algorithmic advances, engineering solutions on implementation. Scholarly books focus on history, development of it, going in depth.
3. Can we develop a novel Reinforcement Learning technique for understanding Human Behavior in Social Media? I have done some background reading in Sociology, Psychology and familiar with this area. I am thinking, there’s vast amount of human behavior pattern collected online. Big-Five, other psychometrics tools are used to predict behavior patterns. Perhaps, in the same direction, there could be a direction.
4. Narratives are everywhere, in news, media, among people, but can we use a Reinforcement Learning agent to computationally organize true narratives vs false narratives? [I am not sure the right terminology]

**Research papers from Social Media and Reinforcement Learning:**

**List of Papers:**

1) Social Behavior Modeling and Optimization through Big Data and Reinforcement Learning

2) Social Reinforcement Learning : AT& T Labs

3) Social and Affective Machine Learning by Natasha Jaques

4) Efficient Deep Web Crawling Using Reinforcement Learning Lu Jiang, Zhaohui Wu, Qian Feng, Jun Liu, and Qinghua Zheng

5) An Adaptive Crawler for Locating Hidden-Web Entry Points:

6) Social Reinforcement Learning to Combat Fake News Spread

7) AIDR: Artificial Intelligence for Disaster Response

8) Fake News: Social Reinforcement Learning to Combat Fake News Spread

9) Deep Reinforcement Learning-based Text Anonymization against Private-Attribute Inference

10) Sieving Fake News From Genuine: A Synopsis by Shahid Alam, University of Victoria, Canada

11) Separating Facts from Fiction: Linguistic Models to Classify Suspicious and Trusted News Posts on Twitter

12) A computational reinforcement learning account of social media engagement

13) Reinforcement Learning on Web Interfaces using Workflow guided exploration

14) Mastering the game of Go with deep neural networks and tree search

15) Deep Reinforcement Learning: An Overview Li Y

16) Mastering the game of Go without human knowledge by David Silver et al

17) Social Computing: From Social Informatics to Social Intelligence

18) Building High-level Features Using Large Scale Unsupervised Learning

19) Fake News Detection on Social Media: A Data Mining Perspective

(Kai Shu† , Amy Sliva‡ , Suhang Wang† , Jiliang Tang , and Huan Liu† †Computer Science & Engineering, Arizona State University, Tempe, AZ, USA)

20) The spread of low-credibility content by social bots

21) Learning to be a Bot: Reinforcement Learning in Shooter Games

**Papers and Summary:**

1) Social Behavior Modeling and Optimization through Big Data and Reinforcement Learning

Solving complex real-world modeling and optimization problems presents several key challenges, including balancing the huge number of agents and system states, considering the complicated interactions between agents, and accounting for constant change in both the environment and the specication of optimality. We propose two approaches to this problem that utilize big data and the reinforcement learning framework. These approaches can be applied to complex social behaviour problems, such as allocating limited resources during natural disaster events and optimizing dynamics in critical infrastructure.

***By Alina Vereshchaka and Wen Dong at U of Buffalo***

URL: http://sbp-brims.org/2019/proceedings/papers/DC%20posters/DC\_Vereshchaka\_poster.pdf

**Summary:**

This paper was presented at SBP BRIMS 2019. The Author has organized a Reinforcement Learning tutorial at the Conference. In addition to that, her work has focused on Reinforcement Learning for PhD.

In this research paper, the authors state, that they are proposing a novel approach of reinforcement learning framework to model optimal resource for natural disasters.

If I understand this correctly, the author is introducing a theoretical framework to tackle the problem of optimal resource allocation. In this case, the author has selected natural disaster particularly New York snowstorm disaster to test the model.

2) “A Social Reinforcement Learning Agent”

Link: https://www.cis.upenn.edu/~mkearns/papers/cobotRL.pdf~

Abstract: We report on our reinforcement learning work on Cobot, a software agent that resides in the well-known online chat community LambdaMOO. Our initial work on Cobot (Isbell et al., 2000) provided him with the ability to collect social statistics and report them to users in a reactive manner. Here we describe our application of reinforcement learning to allow Cobot to proactively take actions in this complex social environment, and adapt his behavior from multiple sources of human reward. After 5 months of training, Cobot has received 3171 reward and punishment events from 254 different LambdaMOO users, and has learned nontrivial preferences for a number of users. Cobot modifies his behavior based on his current state in an attempt to maximize reward. Here we describe LambdaMOO and the state and action spaces of Cobot, and report the statistical results of the learning experiment.

**Summary:**

In this paper, the authors are introducing a novel software agent in a Chat environment. Their goal is to make, “Cobot proactive — that is, to allow him to take actions under his own initiative — in a way that is useful, interesting, or pleasing to LambdaMOO users.”

The main motivation of this research is that most work of Reinforcement Learning has been applied in problems of control, game playing and optimization. However, not a lot of work has been done in Human Computer Interaction. They build their work based on a software agent built named, Cobot that resides in a chat environment.

In a Chat Environment, Cobot, the chat bot is trying to take actions in a complex social environment. This complex social environment is confined within a chat environment where each person texts each other.

Each User has reacted to Cobot in a certain way. In the chat environment, the bot is collecting social statistics and learning social behavior.

Researchers in this paper explore the domain challenges in application of any machine learning methodology to Chat Environment. Cobot is the RL agent that is learning to take social actions, roll calls, suggestions of conversation topic, user introductions. Cobot is learning, which social contexts are appropriate for which actions.

The results from their research work are as follows:

-Cobot received 3171 reward and punishmenet from 254 users

-Cobot modifies his behavior based on his current state in an attempt to maximize reward

3) Social and affective Machine by Natasha Jaques

https://dam-prod.media.mit.edu/x/2019/11/19/PhD\_Thesis\_final\_printed.pdf

Abstract:

Social learning is a crucial component of human intelligence, allowing us to rapidly adapt to new scenarios, learn new tasks, and communicate knowledge that can be built on by others. This dissertation argues that the ability of artificial intelligence to learn, adapt, and generalize to new environments can be enhanced by mechanisms that allow for social learning. I propose several novel deep- and reinforcement-learning methods that improve the social and affective capabilities of artificial intelligence (AI), through social learning both from humans and from other AI agents.

First, I show how AI agents can learn from the causal influence of their actions on other agents, leading to enhanced coordination and communication in multi-agent reinforcement learning. Second, I investigate learning socially from humans, using non-verbal and implicit affective signals such as facial expressions and sentiment.

This ability to optimize for human satisfaction through sensing implicit social cues can enhance human-AI interaction, and guide AI systems to take actions aligned with human preferences. Learning from human interaction with reinforcement learning, however, may require dealing with sparse, off-policy data, without the ability to explore online in the environment – a situation that is inherent to safety-critical, real-world systems that must be tested before being deployed. I present several techniques that enable learning effectively in this challenging setting.

Experiments deploying these models to interact with humans reveal that learning from implicit, affective signals is more effective than relying on humans to provide manual labels of their preferences, a task that is cumbersome and time-consuming. However, learning from humans’ affective cues requires recognizing them first. In the third part of this thesis, I present several machine learning methods for automatically interpreting human data and recognizing affective and social signals such as stress, happiness, and conversational rapport. I show that personalizing such models using multi-task learning achieves large performance gains in predicting highly individualistic outcomes like human happiness. Together, these techniques create a framework for building socially and emotionally intelligent AI agents that can flexibly learn from each other and from humans.

**Summary:**

In the PhD thesis, If I understand it correctly, the author is proposing several novel reinforcement learning methods to improve social and affective capabilities of A.I.

This PhD was published in 2019 and contributes extensively to the field of Reinforcement Learning and Human Robot Interaction.

The Thesis is fascinating due to the cutting-edge contribution to the field of Affective Computing, Reinforcement Learning.

The author focuses particularly on contributing to the following areas:

-algorithms for multiagent social learning

-machine learning techniques for dealing with noisy limited data

-multi task learning models

-deep learning models that improve sensitivity to social and affective feedback for facial expression

In summary, the author presents a unified framework for building socially and emotionally intelligent AI agents. In industry, we have seen the rise of Amazon Echo, Google Smart and plenty of other devices that are taking an active role in our houses, offices.

In Chapter 1, the author is proposing models for learning cues of social behavior, and affective emotional state. Through the state of the art novel algorithms, the author states that in industrial context or in her work, social behaviors of intelligent agents can be improved.

The author uses the example of home automation devices like Alexa or Siri. The devices can pick up social cues from communicating with human beings and function more effectively. In this same chapter, the author is exploring novel ways to develop algorithms in Machine Learning to handle social cues during communicating with a human.

In Chapter 3, the author presents results of multi agent social learning, in which, there was consistent collective reward for social learning. The author believes that improving social intelligence of machine learning algorithms would add to social intelligence, this would significantly improve AI Systems.

Social learning is one component of human intelligence and this PhD thesis has contributed substantial algorithms and techniques in order to fulfil the ultimate goal of building an AI agent that is motivated to increase human well being, satisfaction and flourishing.

4) Efficient Deep Web Crawling Using Reinforcement Learning Lu Jiang, Zhaohui Wu, Qian Feng, Jun Liu, and Qinghua Zheng:

Link: http://www.cs.cmu.edu/~lujiang/camera\_ready\_papers/PAKDD\_2010.pdf

Abstract: Deep web refers to the hidden part of the Web that remains unavailable for standard Web crawlers. To obtain content of Deep Web is challenging and has been acknowledged as a significant gap in the coverage of search engines.

To this end, the paper proposes a novel deep web crawling framework based on reinforcement learning, in which the crawler is regarded as an agent and deep web database as the environment. The agent perceives its current state and selects an action (query) to submit to the environment according to Qvalue.

The framework not only enables crawlers to learn a promising crawling strategy from its own experience, but also allows for utilizing diverse features of query keywords. Experimental results show that the method outperforms the state of art methods in terms of crawling capability and breaks through the assumption of full-text search implied by existing methods.

**Summary:**

Researchers in this paper have applied a novel deep web crawling framework based on Reinforcement Learning. Their motivation is due to lack of work done in Deep Web, a hidden part of Internet.

In this space, traditional search engines do not crawl and access it. Deep Web can be accessed only by onion network, provided by TOR, a specialized browser to protect anonymity. In the case of normal search, which is open internet, there’s incredible amount of research done to improve speed, retrieve information, organize documents.

Commercial Search engines like Bing, Yahoo, Google are constantly working to tweak their algorithms. The authors argue that web crawling can be formulated as a reinforcement learning problem. Using Q-learning algorithm, the crawler is able to learn an effective crawling strategy. In addition to this contribution, the authors have implemented an open source software named, Deep Web Intelligent Miner that crawls deep web.

5) An Adaptive Crawler for Locating Hidden-Web Entry Points:

Link: https://deepweb-sites.com/wp-content/uploads/2015/11/An-Adaptive-Crawler-for-Locating-Hidden-Web-Entry-Points.pdf

Abstract: In this paper we describe new adaptive crawling strategies to efficiently locate the entry points to hidden-Web sources. The fact that hidden-Web sources are very sparsely distributed makes the problem of locating them especially challenging.

We deal with this problem by using the contents of pages to focus the crawl on a topic; by prioritizing promising links within the topic; and by also following links that may not lead to immediate benefit. We propose a new framework whereby crawlers automatically learn patterns of promising links and adapt their focus as the crawl progresses, thus greatly reducing the amount of required manual setup and tuning. Our experiments over real Web pages in a representative set of domains indicate that online learning leads to significant gains in harvest rates—the adaptive crawlers retrieve up to three times as many forms as crawlers that use a fixed focus strategy.

**Summary:**

In this paper, the researchers investigate new methods to improve efficiency in the area of a web crawler. Their goal is to improve qualify of crawler efficiency. In order to do this, they investigate problem of locating hidden web entry points.

They use a learning agent based approach to solve this problem. A learning agent contains the components like a behavior generating element, a problem generator, a critic and online learning element. The whole methodology is unified as Adaptive Crawler for Hidden Web Entries, which is a framework for improving crawler efficiency.

The results of this framework is that it is robust and able to correct biases introduced in learning process. In addition to this, ACHE produces high quality results which are crucial to a number information integration tasks.

6) Applying reinforcement learning for web pages ranking algorithms:

Link: https://www.sciencedirect.com/science/article/abs/pii/S1568494612005674

Abstract:

Ranking web pages for presenting the most relevant web pages to user's queries is one of the main issues in any search engine. In this paper, two new ranking algorithms are offered, using Reinforcement Learning (RL) concepts. RL is a powerful technique of modern artificial intelligence that tunes agent's parameters, interactively.

In the first step, with formulation of ranking as an RL problem, a new connectivity-based ranking algorithm, called RL\_Rank, is proposed. In RL\_Rank, agent is considered as a surfer who travels between web pages by clicking randomly on a link in the current page. Each web page is considered as a state and value function of state is used to determine the score of that state (page).

Reward is corresponded to number of out links from the current page. Rank scores in RL\_Rank are computed in a recursive way. Convergence of these scores is proved. In the next step, we introduce a new hybrid approach using combination of BM25 as a content-based algorithm and RL\_Rank. Both proposed algorithms are evaluated by well known benchmark datasets and analyzed according to concerning criteria. Experimental results show using RL concepts leads significant improvements in raking algorithms.

**Summary:**

In the field of Information Retrieval, commercial web search engines are extremely successful. One of the key component of these web search engines are ranking pages according to keyword search. We find that ranking web page is one of the key concern in search engine.

In every search engine, a user wants to find out a relevant page for a particular key-word. The Search engine has to find an exact page that is relevant to it. The traditional way to formulate ranking is borrowed from the field of Information Retrieval. If I remember it correctly, given a query q and a collection d of documents that matches the query, the problem is to rank and sort in the best possible way.

However, in this paper, this problem from Information Retrieval is formulated as a reinforcement learning problem. The author formulates is as each page as a state, and value function of state is used to determine score of the state (page). The Reward is number of out-links from the current page. The novel contribution of the paper is that the problem of ranking is formulated in the framework of Reinforcement Learning. The authors introduce RL rank, which performs highly in dense web graphs. On Experiments and comparing with PageRank algorithm, RLRank outperforms PageRank using dotIR dataset. It performs better in dense web graphs.

7) AIDR: Artificial Intelligence for Disaster Response

Link: https://chato.cl/papers/demo\_2014\_aidr\_artificial\_intelligence\_disaster\_response.pdf

Abstract: We present AIDR (Artificial Intelligence for Disaster Response), a platform designed to perform automatic classification of crisis-related microblog communications. AIDR enables humans and machines to work together to apply human intelligence to large-scale data at high speed.

The objective of AIDR is to classify messages that people post during disasters into a set of user-defined categories of information (e.g., “needs”, “damage”, etc.) For this purpose, the system continuously ingests data from Twitter, processes it (i.e., using machine learning classification techniques) and leverages human-participation (through crowdsourcing) in real-time.

AIDR has been successfully tested to classify informative vs. non-informative tweets posted during the 2013 Pakistan Earthquake. Overall, we achieved a classification quality (measured using AUC) of 80%. AIDR is available at http://aidr.qcri.org/.

**Summary:**

In this paper, the researchers work on a platform for disaster classification. It is an intelligence platform that uses Machine Learning classification and techniques to analyze twitter data.

The researchers apply it in the field of Social Computing for disaster response. AIDR is Artificial Intelligence for Disaster Response.

During disasters, researchers in this paper argue that they need real-time systems to respond to events. These systems are deployed in a socio-technical environment to understand and respond to natural disaster emergencies. The methodology for this approach is focused on three big modules. They are AIDR collector, AIDR Tagger and AIDR Trainer. Each of these modules are built with a UI to help user to monitor. In using this system, AIDR classifies crisis-related messages from twitter. The researchers contribute extensively to classification of crisis tweets and disasters. They achieve a classification accuracy of up to 80%.

In following the above approach, I could see a potential similar field of election data or social media data. A system like YouTube Tracker could be further improved in classifying youtube videos. Currently, Youtube is used by major platforms to disseminate news on politics, major events. I believe that the above approach could be translated and improved in the same methodology to understand and respond to events through videos. It could classify and predict events through videos in a social media platform like Youtube.

8) Fake News: Social Reinforcement Learning to Combat Fake News Spread

Link: http://auai.org/uai2019/proceedings/papers/370.pdf

Abstract:

In this work, we develop a social reinforcement learning approach to combat the spread of fake news. Specifically, we aim to learn an intervention model to promote the spread of true news in a social network—in order to mitigate the impact of fake news.

We model news diffusion as a Multivariate Hawkes Process (MHP) and make interventions that are learnt via policy optimization. The key insight is to estimate the response a user will get from the social network upon sharing a post, as it indicates her impact on diffusion, and will thus help in efficient allocation of incentive.

User responses also depend on political bias and peer influence, which we model as a second MHP, interleaving it with the news diffusion process. We evaluate our model on semi-synthetic and real-world data. The results demonstrate that our proposed model outperforms other alternatives that do not consider estimates of user responses and political bias when learning how to allocate incentives.

**Summary:**

I presented this paper during last meeting of COSMOS in Fall 2019.

The authors in this paper, develop a new approach to combat fake news by promoting spread of true news in a social network. Traditional method focuses on finding major sources of fake news. Once they identify the source of fake news, steps are taken to block users but this causes human right’s violation.

However, researchers in this paper, focus specifically on limiting the spread of fake news instead of detecting of fake news using community based features. In the context of fake news if true news is spread more and incentivized, then there is more likely dissemination of true news.

To evaluate the performance of their model, they use a Multi Variate Hawkes Process. Social Reinforcement refers to process where acceptance and praise from others in behaviors. In using this, researchers model Social Reinforcement Learning approach, the model learns how to incentivize users to spread true news through true news diffusion.

In the experiment, the authors show that increasing incentives helps to increase the spread of true news.

9) Deep Reinforcement Learning-based Text Anonymization against Private-Attribute Inference

Huan Liu

Ahmadreza Mosallanezhad

Ghazaleh Beigi

Computer Science and Engineering Arizona State University

{amosalla, gbeigi, [huanliu}@asu.edu](mailto:huanliu%7d@asu.edu)

Link: https://www.aclweb.org/anthology/D19-1240.pdf

Abstract: User-generated textual data is rich in content and has been used in many user behavioral modeling tasks. However, it could also leak user private-attribute information that they may not want to disclose such as age and location.

User’s privacy concerns mandate data publishers to protect privacy. One effective way is to anonymize the textual data. In this paper, we study the problem of textual data anonymization and propose a novel Reinforcement Learning-based Text Anonymizer, RLTA, which addresses the problem of private-attribute leakage while preserving the utility of textual data.

Our approach first extracts a latent representation of the original text w.r.t. a given task, then leverages deep reinforcement learning to automatically learn an optimal strategy for manipulating text representations w.r.t. the received privacy and utility feedback. Experiments show the effectiveness of this approach in terms of preserving both privacy and utility

**Summary:**

The authors introduce a new user model to preserve privacy while maintaining important attributes of users while collecting data. They do they through the use of deep reinforcement learning text anonymization.

On applying Deep Reinforcement Learning for text anonymization, they preserve privacy of user and utility. The recent privacy outbreaks from Facebook and other big tech firms show that, this area is of great importance.

10) Sieving Fake News From Genuine: A Synopsis by Shahid Alam, University of Victoria, Canada

Link: <https://arxiv.org/pdf/1911.08516.pdf>

Abstract:

With the rise of social media, it has become easier to disseminate fake news faster and cheaper, compared to traditional news media, such as television and newspapers. Recently this phenomenon has attracted lot of public attention, because it is causing significant social and financial impacts on their lives and businesses.

Fake news are responsible for creating false, deceptive, misleading, and suspicious information that can greatly effect the outcome of an event. This paper presents a synopsis that explains what are fake news with examples and also discusses some of the current machine learning techniques, specifically natural language processing (NLP) and deep learning, for automatically predicting and detecting fake news. Based on this synopsis, we recommend that there is a potential of using NLP and deep learning to improve automatic detection of fake news, but with the right set of data and features. Index Terms—Fake news, Automatic fake news detection, Machine learning, Natural language processing, Deep learning.

**Summary:**

This paper introduces a summary of distinguishing fake news from genuine news. Researchers in this paper present, overview of methodology of fake news detection. It seems that the most common method used in detecting fake news is using Natural Language Processing and Neural Networks.

However, in this paper, researchers are using stylometry method. Stylometry is used for cyber crime detecting. It is popularly used in Forensic detection to detect deception in online writing achieves 96% accuracy. The Machine Learning algorithm used in stylometry method is Support Vector Machine.

**11) Separating Facts from Fiction: Linguistic Models to Classify Suspicious and Trusted News Posts on Twitter**

(<https://www.researchgate.net/profile/Svitlana_Volkova2/publication/318741689_Separating_Facts_from_Fiction_Linguistic_Models_to_Classify_Suspicious_and_Trusted_News_Posts_on_Twitter/links/5b660a730f7e9bd7ae95a303/Separating-Facts-from-Fiction-Linguistic-Models-to-Classify-Suspicious-and-Trusted-News-Posts-on-Twitter.pdf>)

Paper summarized in a talk titled, “Predicting the Future with Deep Learning and Signals from Social Media.” SVITLANA VOLKOVA, PHD

<https://www.cs.jhu.edu/~svitlana/slides/PredictingTheFutureTalkNLPCSS.pdf>

In the talk and slide, Dr. Volkova shares summary of three research papers, she is working currently in Pacific Northwest Government Lab, Washington. I found her work as she used Machine Learning in Social Media.

**Summary:**

The talk and presentation gives a summarization of Social Media Analytics. It describes it as predictive analytics and forecasting analytics. Within Predictive analytics, it seems that detecting world events, deceptive news, native language are important and active area of research. In Volkova’s research and in the presentation, it talks about types of deceptive news.

In the research paper, the key goal of the work is to build a predictive model for classifying news posts. The dataset used contains 130,000 news posts and they predict suspicious news, satire, hoaxes, clickbait and propaganda. The Researchers engineer neural network models rather than lexical models to predict classifying news.

Their contribution in the paper is using neural network architectures for classifying news posts. In addition to this contribution, using social interaction features gives the most weight to classify four types of suspicious news posts.

**Analyzing and Forecasting Targeted Perspectives in Social Media**

**Summary:**

The researchers are currently working on this paper. They have not published it yet. The slides present an introduction to this paper in the presentation. The main idea is that there’s large amounts of multilingual twitter news with entities, people, country. The goal is to build models to forecast language specific connotation dynamics. Using this, they would be able to track perspective change over time on events and entities.

For testing, the researchers used Twitter data during Brussels bombing dataset, and applied a LSTM combined with SVM model. The above two work would contribute to industry especially in finance where companies are mining large amounts of data to infer prices in stocks and other assets.

*Forecasting Short-Term Change in Text Representations during Crisis Events from VK*

**Summary:**

The goal of this paper is to overcome limitation of dynamic topic models and word clusters. In order to overcome, the researchers would need to measure, predict, visualize language dynamics in social media.

Dr. Volkova is forecasting new linguistic terms in regions like Russia and Ukraine. The methodology is using differencing statistics. Using experimental shift in predicting meaning, baseline and evaluation metrics, they are able to visualize meaning shift. The prototype of the work named, “Spatiotemporal Text Representations on Twitter” is built as a web application. Unfortunately, it doesn’t work or contain documentation for researchers to understand. Future work is focused on predicting behaviors and events from social media.

The work of Dr. Volkova could investigate in using Reinforcement learning for behavior prediction, could the above questions of predicting events and behaviors more precise or accurate?

**12) A computational reinforcement learning account of social media engagement**

Link: https://psyarxiv.com/78mh5

Abstract: Social media has become the modern arena for human life, with billions of daily users worldwide. The intense popularity of social media is often attributed to a psychological need for social rewards (“likes”), which turns the online world into a “Skinner Box” for the modern human. Yet despite such common portrayals, empirical evidence for social media engagement as reward-based behavior remains scant.

We applied a computational approach to directly test whether reward learning mechanisms contribute to social media behavior. We analyzed over one million posts from over 4,000 individuals on several social media platforms, using computational models based on reward reinforcement learning theory.

Our results consistently show that human behavior on social media qualitatively and quantitatively conforms to the principles of reward learning. Results further reveal meaningful individual differences in social reward learning on social media, explained in part by variability in users’ tendency for social comparison. Together, these findings support the social reinforcement learning view of social media engagement and offer key new insights into this emergent mode of modern human behavior on an unprecedented scale.

**Summary:**

This paper uses Skinner box, one of the key ideas from animal learning theory. This is one of the foundational Behavioral Psychological ideas that enforces Reinforcement Learning.

A Billion people are spending their time on social media and the researchers are exploring behaviors of human beings.

The paper answers the question, “Can social media engagement be characterized as a form of reward learning?”

The key contributions of this paper are that using social media behavior, researchers find signatures of reward learning and computational models inspired by RL theory. Basic reward learning mechanism contribute to human behavior on social media.

13) Reinforcement Learning on Web Interfaces using Workflow guided exploration

Link:https://arxiv.org/pdf/1802.08802.pdf

Abstract: Reinforcement learning (RL) agents improve through trial-and-error, but when reward is sparse and the agent cannot discover successful action sequences, learning stagnates. This has been a notable problem in training deep RL agents to perform web-based tasks, such as booking flights or replying to emails, where a single mistake can ruin the entire sequence of actions.

A common remedy is to “warmstart” the agent by pre-training it to mimic expert demonstrations, but this is prone to overfitting. Instead, we propose to constrain exploration using demonstrations. From each demonstration, we induce high-level “workflows” which constrain the allowable actions at each time step to be similar to those in the demonstration (e.g., “Step 1: click on a textbox; Step 2: enter some text”). Our exploration policy then learns to identify successful workflows and samples actions that satisfy these workflows. Workflows prune out bad exploration directions and accelerate the agent’s ability to discover rewards. We use our approach to train a novel neural policy designed to handle the semi-structured nature of websites, and evaluate on a suite of web tasks, including the recent World of Bits benchmark. We achieve new state-of-the-art results, and show that workflow-guided exploration improves sample efficiency over behavioral cloning by more than 100x.

**Summary:**

In this paper, researchers focus on improving a Reinforcement Learning agent for web interfaces. In Industry, after the cloud revolution, most Software has moved to Cloud. As a result, Softwares is accessed through web application. It has become prominent and more useful. We rely on it every day for basic tasks like email, booking tickets and banking. As we are doing less cognitive intensive tasks using Web, researchers are working on investigating tools to automate and help our every day life smoother.

In Reinforcement Learning, when there is less reward through trail and error, the agent cannot successfully discover action sequences. In Web Based tasks like Booking Flight Tickets, Replying Emails, a single mistake gets penalized. In order to improve web work flow tasks, researchers introduce workflow-guided exploration, where they define workflows in web context. The results were tested on Alaska-Shi17, a clone of Alaska Airlines, and were able to achieve reward of 0.86 using 10 demonstrations. Research contribution of this paper is investigating web based workflow, experimenting with web tasks to achieve task learning.

14) Mastering the game of Go with deep neural networks and tree search

Link: http://web.iitd.ac.in/~sumeet/Silver16.pdf

Abstract: The game of Go has long been viewed as the most challenging of classic games for artificial intelligence owing to its enormous search space and the difficulty of evaluating board positions and moves. Here we introduce a new approach to computer Go that uses ‘value networks’ to evaluate board positions and ‘policy networks’ to select moves.

These deep neural networks are trained by a novel combination of supervised learning from human expert games, and reinforcement learning from games of self-play. Without any lookahead search, the neural networks play Go at the level of state of-the-art Monte Carlo tree search programs that simulate thousands of random games of self-play. We also introduce a new search algorithm that combines Monte Carlo simulation with value and policy networks. Using this search algorithm, our program AlphaGo achieved a 99.8% winning rate against other Go programs, and defeated the human European Go champion by 5 games to 0. This is the first time that a computer program has defeated a human professional player in the full-sized game of Go, a feat previously thought to be at least a decade away.

**Summary:**

When Google DeepMind’s AlphaGo defeated the best player in Go, it created a record in the field of Artificial Intelligence. This is the classic paper that gives the methodology of mastering the game of go through artificial neural networks.

In this paper, Dr.Silver and his team develop a novel move selection and position evaluation function for Go. The researchers implement this by neural network with Monte Carlo rollouts. In using the new search algorithm they combine it with Monte Carlo, simulation with value and policy networks. Their results show that they achieve 99.8% accuracy against other programs and defeated the world champion in Go.

15) Deep Reinforcement Learning: An Overview Li Y

Link: https://arxiv.org/pdf/1701.07274.pdf

Abstract: We give an overview of recent exciting achievements of deep reinforcement learning (RL). We discuss six core elements, six important mechanisms, and twelve applications. We start with background of machine learning, deep learning and reinforcement learning. Next we discuss core RL elements, including value function, in particular, Deep Q-Network (DQN), policy, reward, model and planning, exploration, and knowledge. After that, we discuss important mechanisms for RL, including attention and memory, unsupervised learning, transfer learning, multiagent RL, hierarchical RL, and learning to learn.

Then we discuss various applications of RL, including games, in particular, AlphaGo, robotics, natural language processing, including dialogue systems, machine translation, and text generation, computer vision, business management, finance, healthcare, education, Industry 4.0, smart grid, intelligent transportation systems, and computer systems. We mention topics not reviewed yet, and list a collection of RL resources. After presenting a brief summary, we close with discussions. This is the first overview about deep reinforcement learning publicly available online. It is comprehensive. Comments and criticisms are welcome. (This particular version is incomplete.)

**Summary:**

This is the best paper that gives summary and overview of Reinforcement Learning. It gives the core components of Reinforcement Learning, advances in the field of it and applications of it. In the field of Natural Language Processing, Reinforcement Learning can be applied in Sentiment analysis, QA, translation, chatbot.

The paper summarizes recent advances and one of the most important events in the field of A.I, AlphaGoZero that learns without any data but from tabula-rasa. It has made a landmark in the field of A.I.

16) Mastering the game of Go without human knowledge:

Link: https://www.nature.com/articles/nature24270

Abstract: A long-standing goal of artificial intelligence is an algorithm that learns, tabula rasa, superhuman proficiency in challenging domains. Recently, AlphaGo became the first program to defeat a world champion in the game of Go. The tree search in AlphaGo evaluated positions and selected moves using deep neural networks. These neural networks were trained by supervised learning from human expert moves, and by reinforcement learning from self-play. Here we introduce an algorithm based solely on reinforcement learning, without human data, guidance or domain knowledge beyond game rules. AlphaGo becomes its own teacher: a neural network is trained to predict AlphaGo’s own move selections and also the winner of AlphaGo’s games. This neural network improves the strength of the tree search, resulting in higher quality move selection and stronger self-play in the next iteration. Starting tabula rasa, our new program AlphaGo Zero achieved superhuman performance, winning 100–0 against the previously published, champion-defeating AlphaGo.

**Summary:**

This paper by Professor David Silver contributes that superhuman level performance can be achieved in the game of go without human domain knowledge. In addition to their previous work of AlphaGo, this is an improvement from AlphaGo. They are able to improve the level of performance significantly, and learning tabula rasa, without any expert human knowledge i.e blank slate. In using this tabula rasa Reinforcement Learning algorithm, the new program AlphaGo Zero is able to achieve 100-0 against their previous program and world champion AlphaGo. The impactful contribution of this research paper is introduction of novel Algorithm that learns tabula rasa

17) Social Computing: From Social Informatics to Social Intelligence

Link: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4136863>

**Summary:**

In this paper, researchers survey an evolution of social computing from social informatics to social intelligence. In Social Computing, theoretical underpinnings are based on social psychology, Human-computer-interaction, social network analysis, anthropology, organization theory, sociology and computational theory. Infrastructure for theoretical underpinning is provided by software-engineering, databases, web technology, and applications of infrastructure are online communities like blogs, social tagging, recommendation engine, feedback, e-government, education, training, storytelling.

Researchers argue that social computing is moving from social informatics to social intelligence where needs like better social software to communicate within societies is one of the biggest need.

18) Building High-level Features Using Large Scale Unsupervised Learning

Link: https://arxiv.org/pdf/1112.6209.pdf

Abstract: We consider the problem of building high-level, class-specific feature detectors from only unlabeled data. For example, is it possible to learn a face detector using only unlabeled images? To answer this, we train a 9- layered locally connected sparse autoencoder with pooling and local contrast normalization on a large dataset of images (the model has 1 billion connections, the dataset has 10 million 200x200 pixel images downloaded from the Internet).

We train this network using model parallelism and asynchronous SGD on a cluster with 1,000 machines (16,000 cores) for three days. Contrary to what appears to be a widely-held intuition, our experimental results reveal that it is possible to train a face detector without having to label images as containing a face or not. Control experiments show that this feature detector is robust not only to translation but also to scaling and out-of-plane rotation. We also find that the same network is sensitive to other high-level concepts such as cat faces and human bodies. Starting with these learned features, we trained our network to obtain 15.8% accuracy in recognizing 22,000 object categories from ImageNet, a leap of 70% relative improvement over the previous state-of-the-art.

**Summary:**

This is a famous paper in the field of Machine Learning developed to represent features using large unsupervised learning. In this paper, researchers focus on building high level class specific feature detectors from unlabeled images. In Computer Vision -- face detecting, most of the work is focused on labelled data, however in this paper, researchers are able to build high level features without labels i.e. un-labeled dataset.

The demonstration of this paper used neural networks to solve the classifying Cat by watching Videos. A Program is able to detect cats by watching YouTube Videos automatically. In similar idea, In Movie Barcode, I think this methodology can be applied to detect anomalies in Video, categorize them.

19) Fake News Detection on Social Media: A Data Mining Perspective

Link: <https://arxiv.org/pdf/1708.01967.pdf>

Abstract:

Social media for news consumption is a double-edged sword. On the one hand, its low cost, easy access, and rapid dissemination of information lead people to seek out and consume news from social media. On the other hand, it enables the wide spread of “fake news”, i.e., low quality news with intentionally false information. The extensive spread of fake news has the potential for extremely negative impacts on individuals and society. Therefore, fake news detection on social media has recently become an emerging research that is attracting tremendous attention. Fake news detection on social media presents unique characteristics and challenges that make existing detection algorithms from traditional news media ineffective or not applicable.

First, fake news is intentionally written to mislead readers to believe false information, which makes it difficult and nontrivial to detect based on news content; therefore, we need to include auxiliary information, such as user social engagements on social media, to help make a determination. Second, exploiting this auxiliary information is challenging in and of itself as users’ social engagements with fake news produce data that is big, incomplete, unstructured, and noisy.

Because the issue of fake news detection on social media is both challenging and relevant, we conducted this survey to further facilitate research on the problem. In this survey, we present a comprehensive review of detecting fake news on social media, including fake news characterizations on psychology and social theories, existing algorithms from a data mining perspective, evaluation metrics and representative datasets. We also discuss related research areas, open problems, and future research direction.

**Summary:**

In this paper, researchers survey review of detecting fake news on social media. Specifically, they investigate process of detecting fake news, evaluating them.

They achieve this in two ways: characterization and detecting. First they characterize what is Fake news, how to classify it. After this, they survey detection methods, performance of each methods. In detection of fake news, researchers classify it into four ways – data-oriented, feature oriented, model oriented and application oriented. For fake news characterization, there’s news content and social context characterization.

The Novel Contribution of this paper is reviewing detection approaches and classifying it from data mining perspective.

20) The spread of low-credibility content by social bots

Link: <https://arxiv.org/pdf/1707.07592.pdf>

Abstract: The massive spread of digital misinformation has been identified as a major threat to democracies. Communication, cognitive, social, and computer scientists are studying the complex causes for the viral diffusion of misinformation, while online platforms are beginning to deploy countermeasures.

Little systematic, data-based evidence has been published to guide these efforts. Here we analyze 14 million messages spreading 400 thousand articles on Twitter during ten months in 2016 and 2017. We find evidence that social bots played a disproportionate role in spreading articles from low-credibility sources. Bots amplify such content in the early spreading moments, before an article goes viral.

They also target users with many followers through replies and mentions. Humans are vulnerable to this manipulation, reshaping content posted by bots. Successful low-credibility sources are heavily supported by social bots. These results suggest that curbing social bots may be an effective strategy for mitigating the spread of online misinformation

**Summary:**

In this paper, the researchers show that social bots are an effective tool for manipulating news on social media. They conclude that curbing social bots may be an effective way to mitigate spread of low-credible news. Researchers introduce novel idea that in curbing low credible news, true news can be spread. They also could accomplish this through partnership between social media platforms and their research lab. They are developing machine learning algorithm to detect social bots.

21) Learning to be a Bot: Reinforcement Learning in Shooter Games

Link: (https://www.aaai.org/Papers/AIIDE/2008/AIIDE08-013.pdf)

Abstract:

This paper demonstrates the applicability of reinforcement learning for first person shooter bot artificial intelligence. Reinforcement learning is a machine learning technique where an agent learns a problem through interaction with the environment. The Sarsa( ) algorithm will be applied to a first person shooter bot controller to learn the tasks of (1) navigation and item collection, and (2) combat. The results will show the validity and diversity of reinforcement learning in a first person shooter environment.

**Summary:**

The author introduces current trends of research in Reinforcement Learning. In the paper, he states that a lot of research work has been done in the area of Games using Reinforcement Learning. However, not much work has been done in first-person shooter games for Reinforcement Learning. The authors conclude that sarsa algorithm can be used to learn bot personality types and learn navigation and combat.

What I like about this paper is that they are investigating an application of Reinforcement Learning in First Person Shooter Games. This gives me clues and understanding that in a similar approach, Reinforcement Learning can be applied in the environment of Social Media.