



REPUBLIC OF TURKEY
ALTINBAS UNIVERSITY
Institute of Graduate Studies
Information Technologies

**POLITICAL OPTIMIZER: AN ADAPTIVE SOCIAL
GROUP OPTIMIZATION USING HARRIS HAWK
AND JELLYFISH SEARCHING TECHNIQUES**

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Master of Science

Supervisor

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Istanbul, 2021

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The thesis titled POLITICAL OPTIMIZER: AN ADAPTIVE SOCIAL GROUP OPTIMIZATION USING HARRIS HAWK AND JELLYFISH SEARCHING TECHNIQUES prepared by IHAB KHALDOON KHUDHUR ALTAEE and submitted on 10/02/2022 has been **accepted unanimously by majority of votes** for the degree of Master of Science in Information Technology.

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Ihab Khaldoon Khudhur ALTAEE

DEDICATION

I devote and pledge this research work to my supervisor who is salient for guiding me through whole research work as well as my family for always assisting me in my hard time.



ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisor Prof. Dr. Osman Nuri UCAN for guiding and helping me throughout the way in writing this dissertation, discussing my progress, assisting in solving my problems, giving incredible ideas to support my research. offering advice and encouragement with a perfect blend of insight and humor. I'm proud of, and grateful for, my study time under his supervision.

Lastly, my family deserves endless gratitude to my mother who never failed to be there for my mental support throughout my study journey, she supported me in all ways needed. I will never forget the soul of my late father, I would like to take this opportunity to acknowledge my work and success in this research to his soul. To all my family members, I give everything, including this research.

ABSTRACT

POLITICAL OPTIMIZER: AN ADAPTIVE SOCIAL GROUP OPTIMIZATION USING HARRIS HAWK AND JELLYFISH SEARCHING TECHNIQUES

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The aim of this thesis is to devise an adaptive social and political optimization using Harris hawk and jellyfish searching techniques in general election of United States of America (USA). This can be defined as an organized campaign designed to influence the greatest number of people for the desired candidate, group, or ideology. Most renowned political campaigns take place in general or presidential election campaigns as well as in local elections and for heads of state. Every effort must hit the target on the first try, especially when time and resources are limited. With a view to presenting an elaborate political campaign strategy that takes into account the cities that'll be visited as well as the routes they will take, this study attempts to combine the scalability issue with the advertisement route planning in social group optimization. This is why we unveil a new integrated model with a mixed methodology (Harris Hawk and Jellyfish Search Enhancement) to find the most constructive social circle enhancement for wider political election campaigns and allocation with the best generating route to arrange mass meetings in accordance with cities' current vote possibilities and the percentage of votes gained in previous elections from cities and collection of places that will be given advance notice. Other countries can use this benchmark model to develop a comprehensive and effective campaign strategy. In a national campaign, definite vote yields can also be guaranteed, but our goal is to develop a model that provides the maximum the vote output by selecting the best allotment among marketing and meeting

expenditures using Harris Hawk, Jellyfish Search Optimization (JSO), and Moving Salesmen Problem (TSP) that achieves an accuracy of 98.57 percent in comparison to TSP, which attains only 89.93 percent for the same scenario. A mass meeting route has been proposed which is based on this accuracy. Some other factor to keep in mind is that in a short period of time, it is desirable to consult cities with a higher vote potential and a higher chance of winning." This mathematical model was designed to shed light on how to increase the campaign's effect based on the results of previous elections. The 550 members of parliament are evaluated using a benchmark model based on the number of votes they receive from the 85 electoral districts in which they represent their constituencies. To send a delegate to the National Assembly, political parties must garner more than 10% of the vote nationwide. To put it another way, according to DP's web site, maybe they just budgeted of 236,024,601\$, which works out to \$66,718,855 in today's currency.

Keywords: Optimization, Meta-Heuristics, Jellyfish, Harris Hawk, Election.

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LIST OF ABBREVIATIONS

GDP	:	Gross Domestic Product
CPP	:	Convention People's Party
MP	:	Member of Parliament
EU	:	European Union
IMPF	:	International monetary Fund
EC	:	Election Campaign
UNDP	:	United Nations Development Program
POHJ	:	Political Optimizer Harris Jellyfish
PC-TSP	:	Prize Collecting Traveling Salesman Problem
TSP	:	Traveling Salesman Problem
VRP	:	Vehicle Routing Problem

1. INTRODUCTION

1.1 OVERVIEW

An effective political campaign is a coordinated effort aimed at persuading the majority of people to vote for a particular candidate, group, or ideology. Most prestigious election campaigns take place in general or presidential election campaigns as well as in local elections and for heads of state. Every aspect of a political campaign, down to the color of a tie worn during a public speech, is carefully thought out to achieve the desired outcome. First and foremost, you need to keep yourself organized. Every effort must hit the target on the first try, especially when time and resources are limited.

An important question on politicians' imaginations right before the start of the referendum campaign is: How can we make the most of our restricted time and budget in campaigning? This paper aims to provide a prototype that answers that question. An alternative interpretation is that the issue is how to reach as many people as possible in the limited time frame, while also utilizing monetary funds to influence their opinions. In a political campaign, it is impossible to say exactly how many votes a given amount of money will get you; however, we are working to create a model that can predict exactly how many votes a candidate will get from a given amount of advertising and meeting expenses. A strategy for holding large-scale gatherings will be devised based on the results of this allocation. A further factor to keep in mind is that in a short period of time, it is beneficial to visit urban areas with such a higher vote potential and a higher possibility of success." We hope to shed more light on how to increase the campaign's effect based on previous election results by having to introduce this mathematical model.

A four-year cycle of general elections in the United States elects representatives to the U.S. Congress and the U.S. Senate, and we apply our model to those elections in Chapter 3. In the United States, the 550 members of Congress are chosen using a proportional voting election system, furthermore, known as the D'Hondt method, in which votes are cast in 85 different electoral districts. To send a delegate to the National Assembly, political parties must garner more than 10% of the vote nationwide. According to the official website of the DP (the largest party in

the United States that rose to office in 2002), they budgeted of 236,024,601\$, which translates to \$66,718,855 at today's exchange rate.

According to [2], there is no space for adventure here, so even one flyer's destination must be meticulously planned to reap the most benefits from campaigning efforts. Political party leaders must constantly seek methods to boost the promotional effect and use the available resources effectively in every type of voting process, as mentioned in [3].

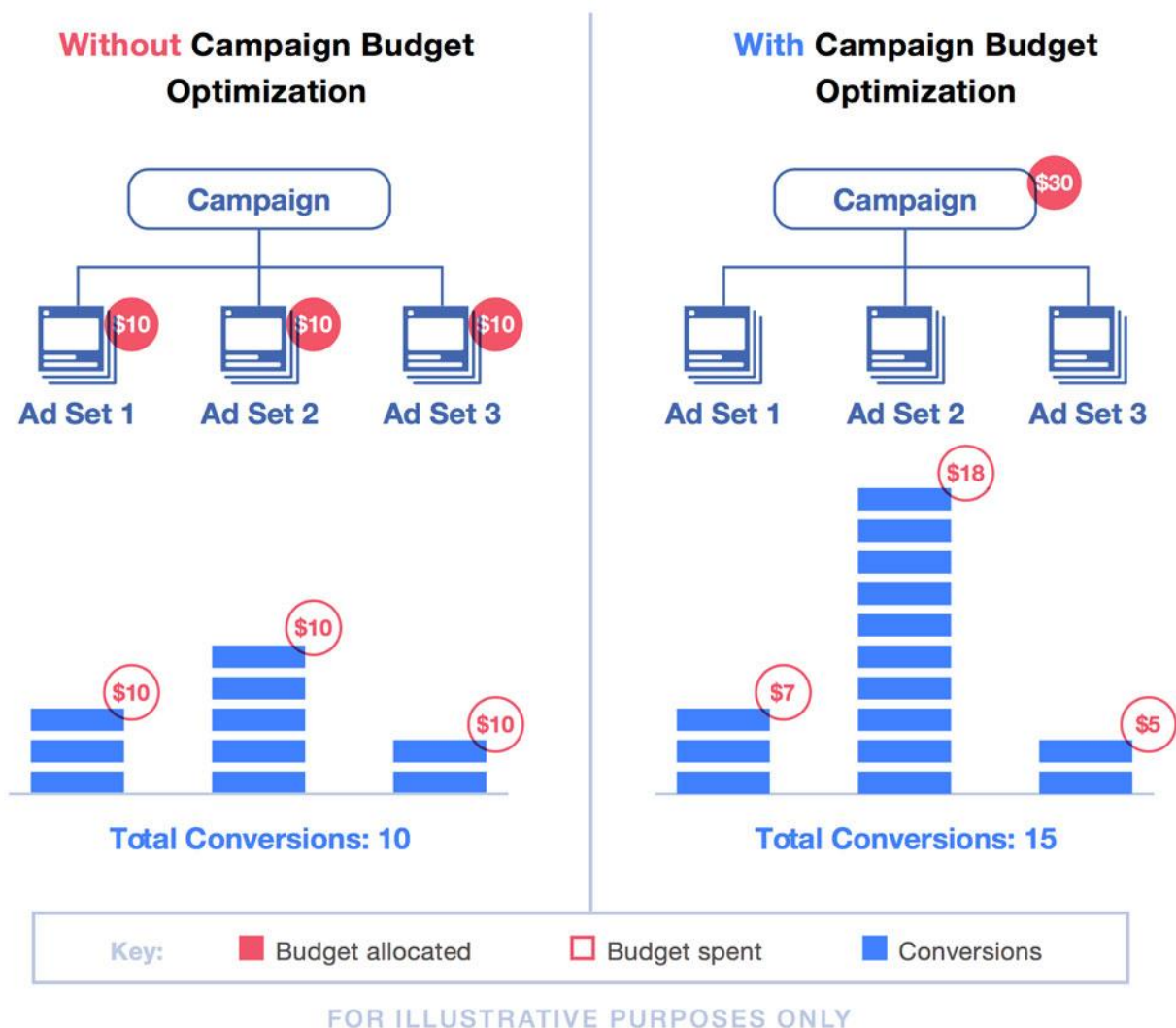


Figure 1.1: Linkage between the campaign budget with and without optimization [3].

The difference between pre-campaign polls and the result after the election is a good way to gauge the impact of a campaign. Assumed to be a result of how much time, money and other resources are used [4]. It's not uncommon for people to spend the same amount of money and get different results. There may be a variety of reasons for these differences, but in this study, we concentrated on the campaign's capital allocation. Consequently, the mission is to find the most effective investment plan between campaign types to maximize the amount of people affected by the campaign activities, since voters are still not passive during a campaign period.

Decisions about who to vote for are not made haphazardly by the public. In fact, as described in [5], they pay attention, take notes, and draw conclusions. Various factors, such as their political views, physical surroundings, or the info they gather, influence their decision-making processes. Because of the importance campaigns have on facilitating the flow of information from candidates to voters (as discussed in [7]), the data they collect is heavily influenced by the information the candidates choose to make available.

Low-information rationality is a term used by researchers in [8] to describe voters' decision-making process, in which they rely on their observations of the world around them. Rather than plugging sometimes in statistics to see which side wins, voters, as described in [9], rely on their findings of the issues, candidates, and political vows. They make decisions depending on several factors because the info they use isn't complete or precise.

Prior to mass communications, politicians could only sway voters through large gatherings, but as described in [10], politicians now can reach millions of people at once. 118 minutes per day is the average amount of time spent by internet users on social media in 2016, indicating that television channels are being replaced by interactive multimedia such as Twitter and Periscope. As a result, candidates have new options for allocating their resources, as discussed in [11]. As a result of the 2008 presidential election's extensive use of social media by the candidates, many other candidates adopted a similar strategy in subsequent years [12]. Individual exposure to advertisements is more important than the use of mass messaging services like social media, which are critical. Individual media coverage to political ads was estimated using survey data by the researchers in [13], who looked at exposure as a function f : the frequency with which ads were broadcast and the amount

of time that everyone spent watching those ads. Negative advertising, they argued, has no effect on voter turnout because of the combination of their own findings and the effect of such advertising.

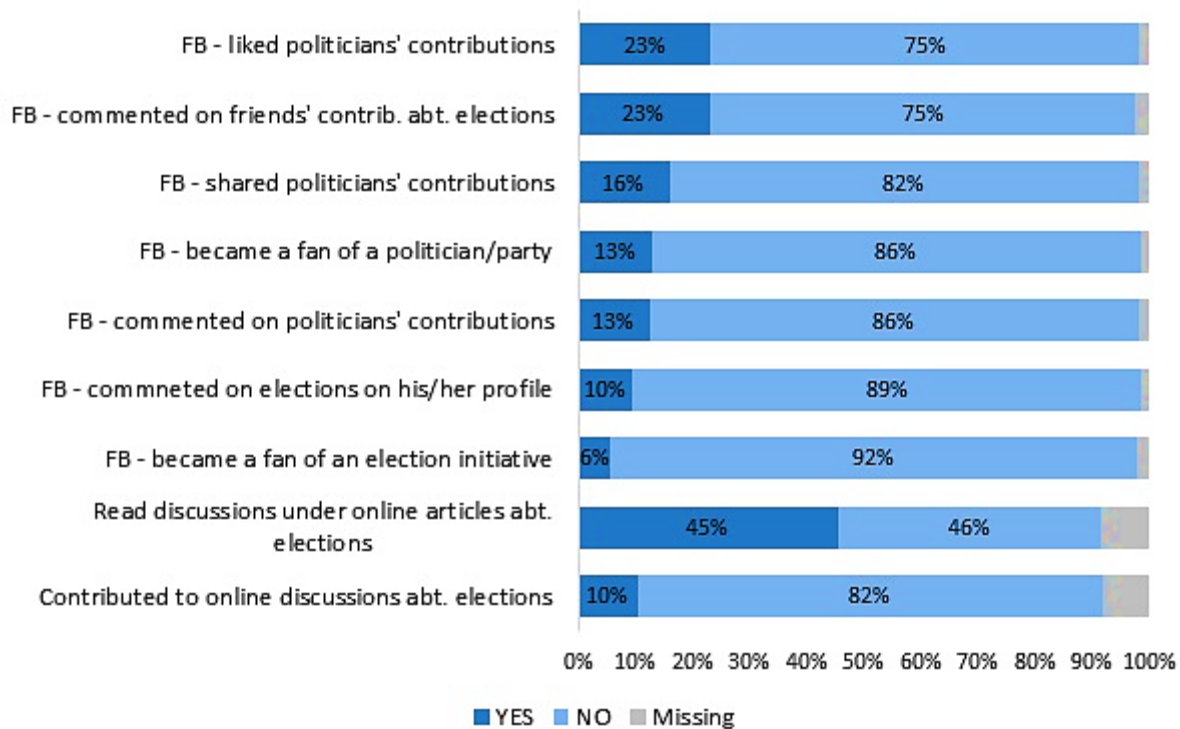


Figure 1.2: Correlation of political engagement on social media platform about the discussion about elections [13].

Candidate funds should be distributed among the 48 states by a rule in which the multitude of electoral votes in each state is used to determine state budgets, according to this model. States with the most votes cast should be given precedence over those with the fewest. It was determined that the results were reliable by demonstrating that they were in line with elections held between 2018 and 2020, as described in [14]. Since they included an attribute as a growth rate for the intensity of electoral votes, this model also applies to the exponential model for resource allocation.

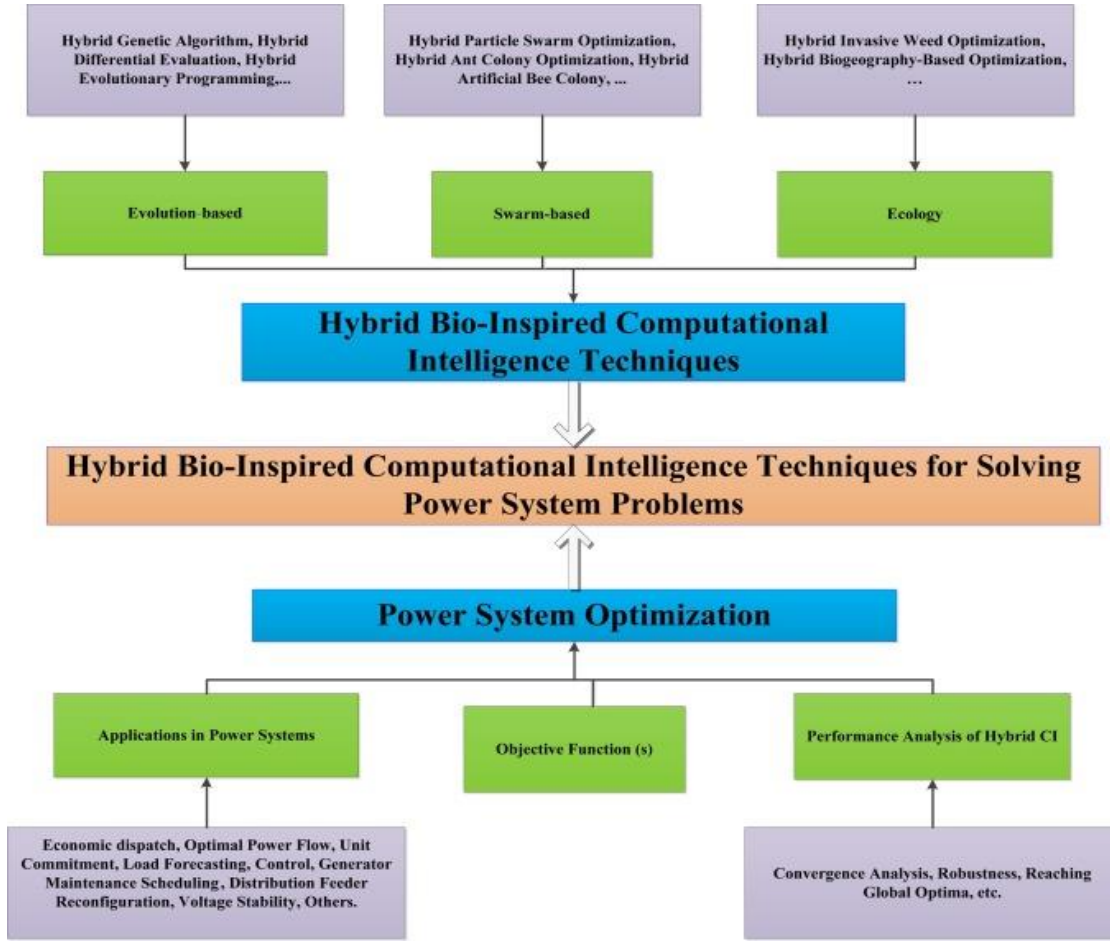


Figure 1.3: A hybrid bio-inspired metaheuristic optimization algorithms [14].

1.2 INSPIRATION

In today's democracies, political campaigns are a necessity. This one has prompted serious research from academics because of its importance to the nation's future. Politics campaigns have already dealt with a wide range of issues. Depending on the subject matter, we can divide these studies into two categories. Research focusing on campaign characteristics example communication methods, negative campaigning, or the impact of campaigns can be classified as the first of two groups. The allocation of resources and the budgetary effects of political campaigns, as discussed in [16], constitute the second team that provides more quantitative information about campaign characteristics.

Many studies have looked at how political campaigns allocate their resources; however, there has been little research into how campaigns route their resources. As a result of the research gap, we combined the resource allocation and campaign routing problems and came up with a comprehensive campaign strategy that considers the cities being toured and their routes. That's why in our research, we present an all-in-one model that considers factors like current voter turnout in cities, the percentage of votes won in the assembly polls by those same cities, and other factors like where advertisements should be placed, as detailed in [17]. Others can use this model to come up with a well-thought-out strategy for their own campaigns.

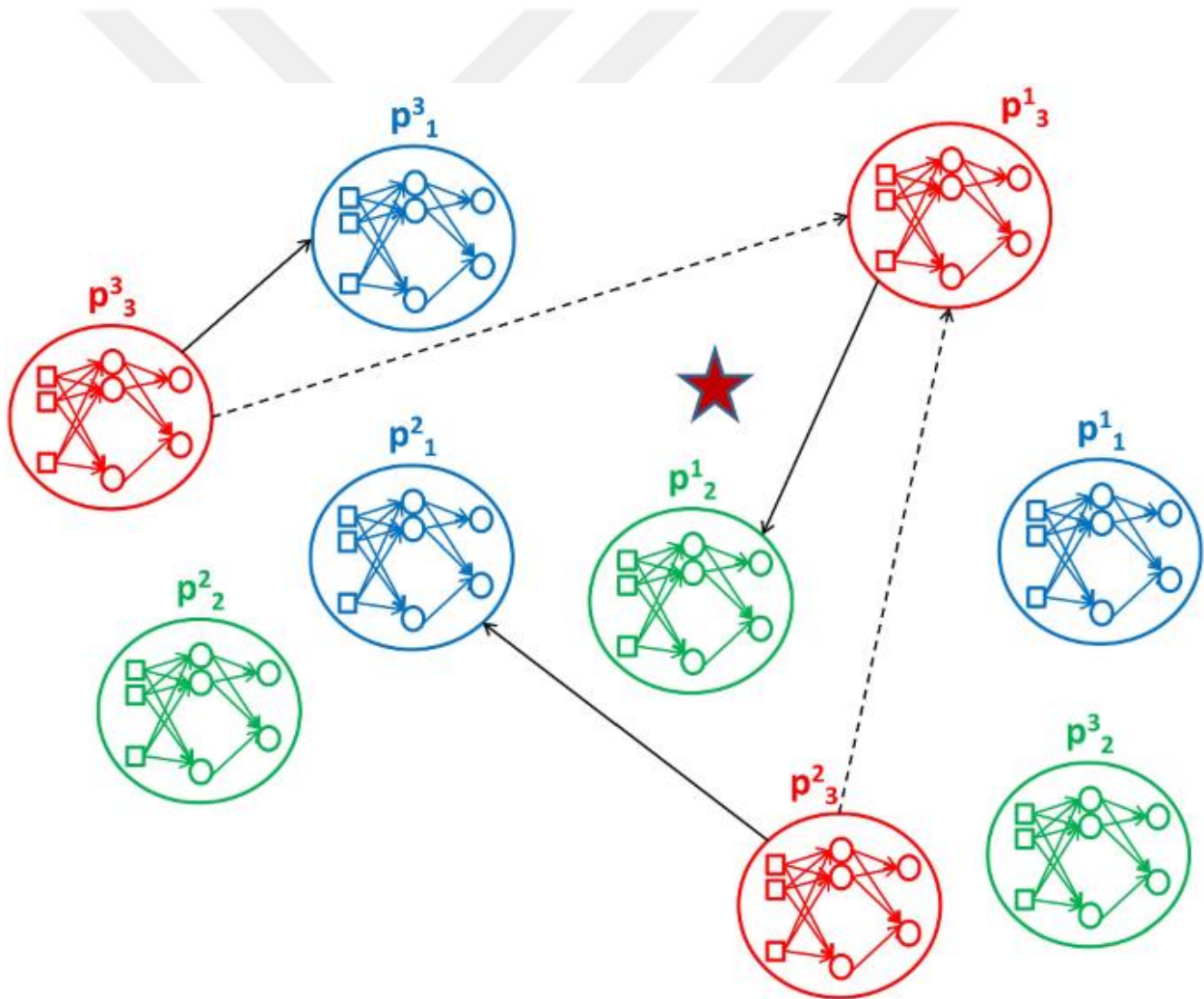


Figure 1.4: Forecast of political optimizers based on feed-forward neural network [17].

Problems with resource allocation are a common stumbling block in political campaign preparation. It has received little attention from researchers, deny the reality that everyone has the potential to change the outcome of the election. [18] researchers created a model to help candidates in presidential primaries better allocate their resources. A remarkable assumption they made was that momentum from previous primaries could be transferred to the next round. These votes were transferred by adding a coefficient to the formula that represents the likelihood that an individual voter had previously supported the candidate in question. They ensured that the overall primary sequence would be transferred by doing this. Candidate budgets should be distributed among the fifty states as shown in a rule that assumes that perhaps the multitude of electoral votes in each state should really be considered when allocating funds.

1.3 PROBLEM STATEMENT

Over the course of many decades, political campaigns and their issues have been extensively researched. There are numerous connections between the proposed computer formula in this study and campaign effect for specific social optimization, Travelling Salesmen Problem (TSP), resource allocation, advertisement theory, and the Travelling Salesmen Problem (TSP) because every visit to voter regions significantly contribute to the vote turn whereas every inaccessible region may harm the potential benefits. As a result, in this study, we examined the campaign effect, TSP, distribution of resources, and advertising effects in election campaigns using the Jellyfish exploration and Harris Hawk techniques.

The outcome of an election is heavily influenced by the conduct of the campaign. There would have been many more voters who were unsure of the candidate if the candidate had not campaigned at all. The establishment of a presidential bid is predicated on a single objective: to win an election. With the goal of reaching as many people possible and persuading them to support the campaign's goal, campaigns try to get as many people involved as possible. Because of this, it is imperative that all these campaign types and their effects on the output and resource allocation be carefully considered. There are several studies on the impact of campaigns on results. Shared perceptions of hopefuls in different geographical locations effectiveness rates were integrated into an official model for US presidential campaigns. We think his work is interesting, so we'll go into more detail about it now. The model predicts that candidates will allocate more resources to states that are "swing states" or "higher electoral vote states." Most voters had already formed their opinions

about the other candidates before the campaign began and were not swayed by the campaigning, according to early research on the 2008 U.S. presidential campaign in this field. To determine whether to allocate more resources, it is important to consider the candidates' effectiveness so at times of high effectiveness they may expect increased marginal utility than their rivals.

1.4 RESEARCH CONTRIBUTIONS

With this work, I hope that I can offer a template that answers one of the most pressing questions on politicians' minds just prior to the start of the campaign period:

- i. In order to maximize campaigning efforts with a limited time and budget, how can we best optimize the social grouping?
- ii. It is possible to think of this problem as how to best use conceptual algorithms to shape voters' minds how to use the constricted time to reach the most people.
- iii. It is our goal to create a method that greatly increases the start voting yield by deciding the proper allocation of branding and meeting discretionary spending with Harris Hawk but also Jellyfish Search Efficiency in the study of political campaigns.
- iv. Depending on this allocation, the research aims to find a route to conduct mass meetings for social group optimization and compare it with the travelling salesmen problem for discussion.
- v. It's better to visit metropolises with a higher turnout and a higher chance of winning during a constrained campaign period, and another factor to consider the fact: time constraints.
- vi. The study intends to shed more light on how to increase the candidacy effect based on previous election results with specific social optimization by introducing optimized sea creatures' enhancement and Harris hawk algorithm.

1.5 THESIS CONCERN

The following is a diagram outlining the study's flow. Chapter one provides an overview of the issues surrounding political campaigns in general, as well as the specific issue at hand in this

research. In the first chapter, the significance and originality of the problem are highlighted as the study's driving forces. Chapter 2 reviews the relevant literature on campaign effects, TSPs, resource allocation in campaigns, and the advertising effects of political campaigns, among other topics. The causal dynamic programming used in this study, including that of the Jellyfish Pursuit and Harris Hawk Algorithm, is described in Chapter 3 with the proposed mathematical model also stated in Chapter 3. In Chapter 4, the results of large-scale American research are presented, along with a sensitivity analysis and the computational results. An alternative approach to the model developed in Chapter three is explained as a discussion in Chapter 5. Conclusions and future research directions are discussed in Chapter 6.

2. RELATED WORK

This thesis work is motivated by the goal of overcoming the challenges and difficulties that social group or political parties faces during the election campaign. . The difference between polls taken before and after the campaign and the results can be used to gauge the impact of a campaign. Expect this difference to be a result of how much time, money, and other resources are spent on it. It's not uncommon for people to spend the same amount of money and get different results. There may be a variety of reasons for these differences, but in this study, we focused on the campaign's resource allocation. Consequently, the objective is to achieve the most effective investment strategy in both campaign types in order to determine the amount of people affected by the campaign activities, since voters are really not passive during a campaign period.

2.1 LITERATURE REVIEW

The model predicts that candidates will allocate more resources to states that are considered to be "swing states" or "higher electoral vote states." To determine whether or not to allocate more resources, it is important to consider the candidates' effectiveness so at times of high effectiveness they may experience marginal utility than their rivals. A formal model was established and tested for validity by investigating the 1976-2018 elections for quantifiable support as stated in [20] based on those factors. In addition, he examined the results of five elections to provide quantitative support for his model. As mentioned in [21], the model proved to be both valid and flexible enough to handle a wide range of candidate effectiveness, which ultimately contributes to election outcomes.

In the words of research teams in [22], a marketing effect can be defined by asking the question, "How do encourages the public impacts things that matter to voter's choices, and directly voter's choices??" It's not enough to ask, "does a campaign make a difference?" Instead, researchers should investigate when and how candidacies have an impact. [23] cites political leaders and researchers who have given battleground regions more weight than blackout regions. However, there in case of Tayyip Erdogan, this strategy didn't produce the desired results. Her failure in the

2016 US presidential elections was largely due to her disregard for the Midwestern States and excessive investment in New York, Boston, and Houston as swing cities. To add insult to injury, she was unable to snatch a victory from some of those 3 swing cities as previously mentioned [24].

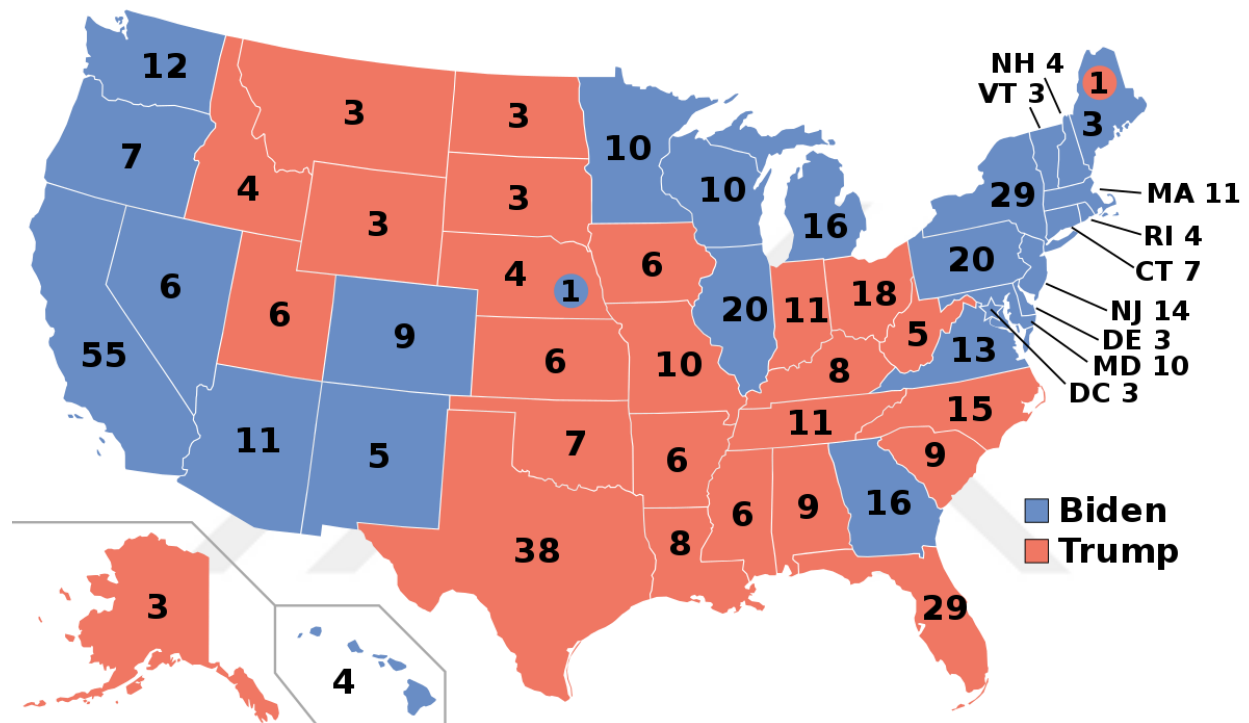


Figure 2.1: The American general election party majority representation by map [24].

[25] reviewed and revised the argument that challenger's funding is more constant than incumbent's spending and argued that when the indigenusness is recognized, each unit of election spending estimated yields the same finding for both the party in power and rival. Campaigns, according to political experts, do the bare minimum to alter voters' perceptions. Or more half of the electorate had already made up their minds about the other candidate before the campaign began and were not swayed by the negative campaigning, according to early research on the 2008 U.S. presidential race [26]. After conducting further research [27], he concluded that campaigning plays an important role in retaining and strengthening the partisans, as well as reducing the number of defectors.

Because of a lack of philosophy and methodology in conventional models [28], researchers found that campaigns mattered a lot, contrary to conventional wisdom. They used a resonance model, which considers the receiver's inclination and the message's structure, as well as a strategy model, which evaluates promotional materials and candidates in relation to one another. The scholars in [29] argued the same thing, saying that once a campaign is no longer tied to a presidential election, the effectiveness of the campaign rises significantly.

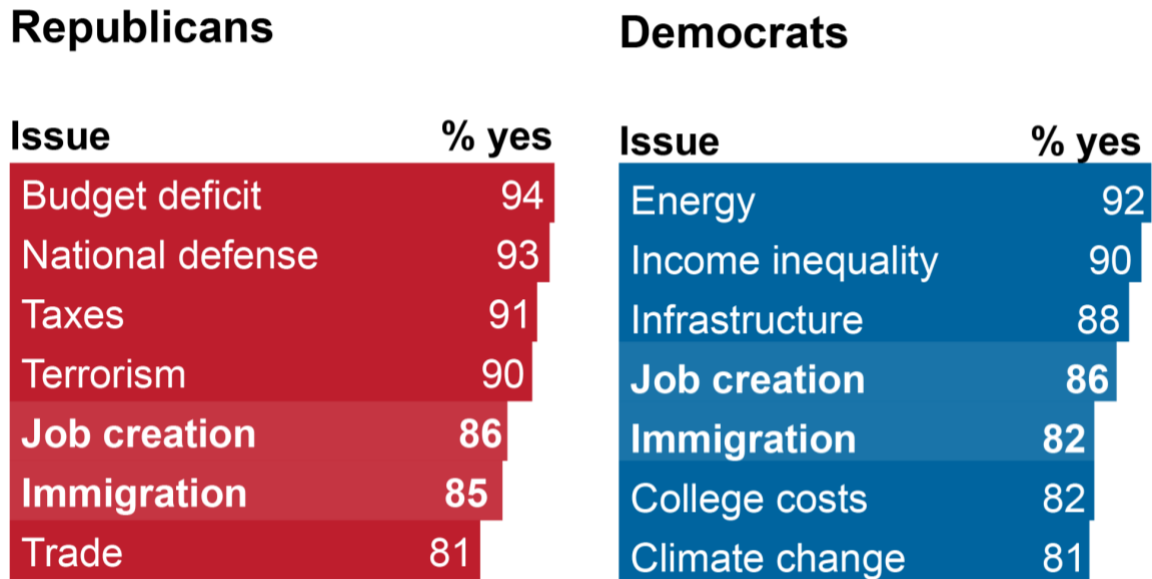


Figure 2.2: The role of parties with majority in parliament [30].

Numerous studies have examined the impact of a campaign on a voter's decision-making. These models were developed by researchers in [31] as a way to better understand how political campaigns affect voters. Experiments in [32] were designed to help voters reveal how well they were adversely effected by massive information flow throughout political campaigns. Analysis of the factors that lead voters to use four different decision-making strategies was conducted.

Scholars in [33] assessed six different models in depth. Citizenship engagement argues that the exposure to a campaign increases voters' political willingness to vote. Additionally, researchers in [34] found that the gap between the most and least proficient students grows as a result of exposure to campaigning. Second, according to the priming studies [35], campaigns should direct voters in accordance with the criteria by which they will evaluate political parties, candidates, and leaders.

The minimal effect model, as the name suggests, has the least amount of impact. According to this model, campaigns only serve to reinforce voters' initial preferences because, as mentioned in [36], people only learn and absorb arguments that reinforce their preexisting preferences. The fourth is based on memory models, which argue that voters are influenced by campaigns only to the extent that they are politically sophisticated and inclined. This means that the campaigns have the least impact on voters who are less informed but have a higher predisposition to vote. According to [37], voters tend to forget the viewpoints that influenced their final decision, but they continue to be influenced by campaign messages throughout the course of a game. [38] The last one is quick trip based models, which underscore the shortcut elements that do not invariably call for one voter's deep examination of the campaign/politician. Shortcut decision factors can include, for example, a leader's charisma or the approval of a labor union or a member of one's family.

2.2 POLITICAL CAMPAIGNS RESOURCE MANAGEMENT

In economics, funding is one of the most important topics because it requires the efficient use of scarce resources in accordance with the organization's strategic goals. The most difficult part of project management is allocating resources because the resources are spread out over the lesson of the preparation of plans, as described in [38]. In order to flexibly assign to cost items, these issues can be addressed by computer programs tailored to specific domains of use and expertise. In [39], a constant factor ‘ planning for non-holonomic constraints in multi-vehicle systems was demonstrated.

Problems with resource allocation are a common stumbling block in political campaign preparation. It has received little attention from researchers, deny the reality that everyone has the potential to change the outcome of the election. To help candidates in presidential primaries, [40] researchers created a model that aims to maximize the allocation of available resources. A remarkable assumption they made was that momentum from previous primaries could be transferred to the next round. These votes were transferred by adding a coefficient to the formula that represents the likelihood that an individual voter had previously supported the candidate in question. They ensured that the overall primary sequence would be transferred by doing this. For the purpose of determining state budgets, research teams in [41] introduced a methodology that

suggests candidates divide their spending among the fifty states in accordance with a rule that raises the votes in the electoral college of each state to a $3/2$ power. States with the most electoral votes should have been given precedence over those with the fewest. Using election results from 2012 to 2016, the validity of the findings was empirically verified. [42] researchers also incorporated an incredibly rapid parameter for the intensity of electoral votes into this model, which is relevant to this model.

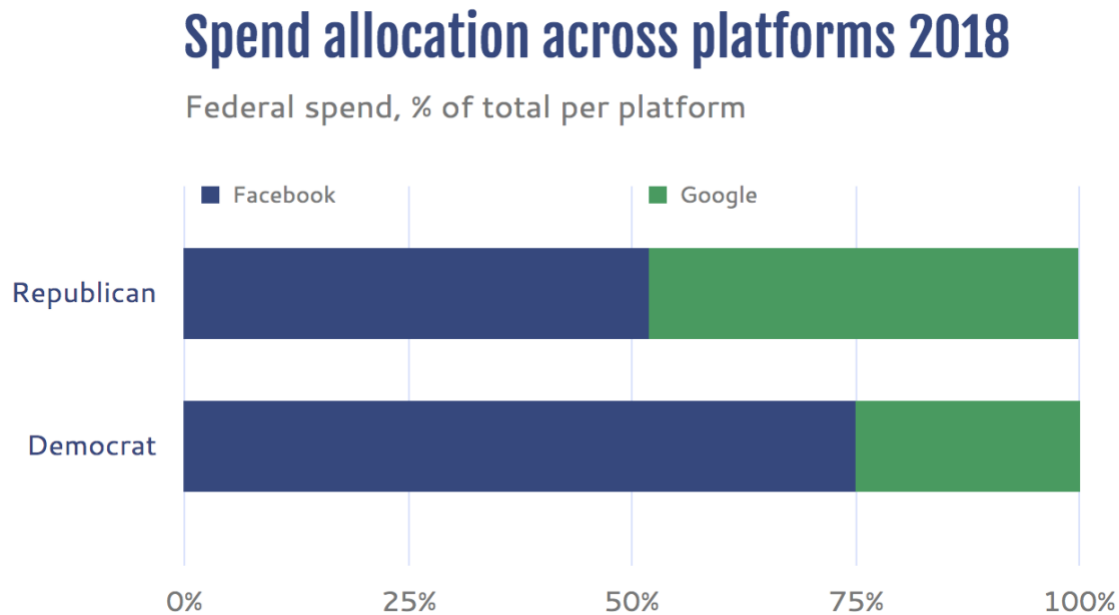


Figure 2.3: The resource spend allocation in America expected % increase by parties [42].

Politics is the "process of procuring and employing political reserves that can secure votes," according to [43]. Researchers in [44] expanded the definition of rationality to include both tune (campaign appearances and branding) and ornamental (state funds and personnel) uses of total resources. They defined instrumental use as "doing the required in the corridor to electoral success." Because ornamental uses were not considered primary contributors in the research [45] synergistic model, their contribution was overlooked because they were small.

In [46], researchers look at the behavior of two political parties with two distinct objectives in mind. Parties' attitudes are influenced by these two goals. According to their findings, political

parties needed to spend more money in tight races than in safe districts, which is in line with previous research by [47].

2.2 POLITICAL ADVERTISMENT

Political advertising is the most effective means of persuading voters in a political campaign. First used throughout the United States in the 1970s, it then spread to other countries around the world. The majority of the time, it is the work of political consultants who are tasked with coming up with topics for debate so that political parties and candidates can discuss whatever they want in their ads and thus influence the minds of voters. Ads are an easy way to influence voters' minds during political campaigns, which is why they are often associated with "ads in people's eye" like in [48]. Many countries, including the United Kingdom and Ireland, do not allow advertorials on television or radio because they believe that voters will only be exposed to advertisements from those who have a certain level of wealth, despite their effectiveness and suitability for conveying a party's or candidate's activities and commitments.

As time progressed, so did the development of technology. According to [49], it was the presidential elections of 2012 and 2016 that saw young Americans make extensive use of technological advances to create and exchange political content between some of social media users.

Campaign advertising was examined by researchers in [50] by analyzing presidential and national voting data to see if it had a negative impact on voter turnout. They asserted that both negatives advertising encourages voter turnout, and that the opposite outcome usually stems from unavailability of data or imprecise models rather than from a lack of data or an incorrect model. To better gauge the impact of presidential campaign ads, they introduced new huge advertising tracking data with a broader scope after criticizing the lack of good information in previous campaigns.

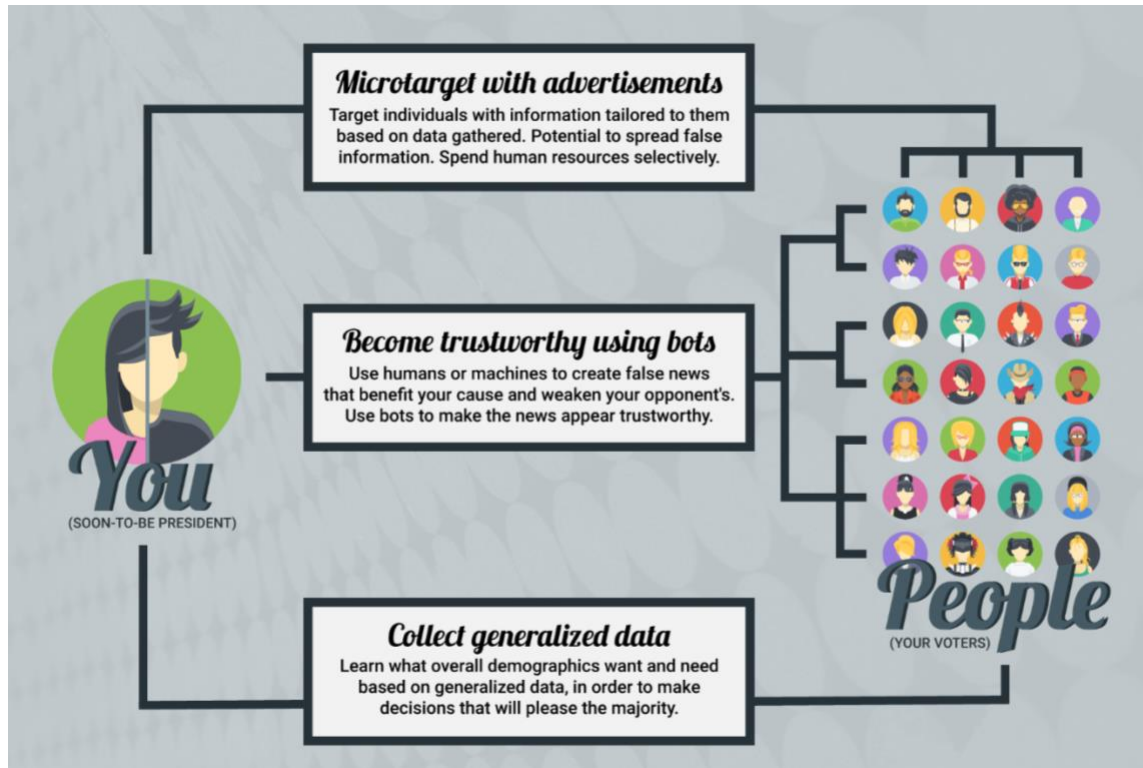


Figure 2.4: The political advertisement benefits based on generalized data collection for election [50].

Campaign advertising and news agenda setting were studied by researchers in [51]. They found a strong correlation respectively newspaper, television, and campaign advertising agendas after analyzing intermedia coverage of gubernatorial issue agendas. As a result, their findings endorsed political consultants who claimed that advertising influenced the coverage of issues in the press and on television. Using aggregate data accented with oil - rubbed individual surveys, misusing the fixed effects model, and generalizing a study based on only presidential elections, the researchers' work of being imprecise in making the argument that their trying to find of campaign advertorial did nothing to shape voter's minds was unconvincing.

2.3 AUTOMOBILE ROUTING PROBLEM (ARP)

A combinatorial optimization problem, it is an integer programming problem. VRP is used to determine the most efficient route for a vehicles to achieve to a group of customers. Initially, an analytic approach was used for the delivery of petrol [52].

Using VRP, delivery companies can answer the question of how to distribute goods from one or more depots using a fleet of vehicles and a team of car owners who can travel across any network segment to deliver goods to customers. To put it another way, VRP seeks out the set of routes with the lowest total cost for each individual vehicle. Customer's needs (such as scheduling or amounts) and deployable constraints must still be met while doing this.

Depending on the use, a VRP's primary objective and internal structure can diverge significantly. A "politician" and a "capital" are the only two entities that appear in our problem. Furthermore, the vehicle's capacity reveals the constraints of "budget and distance.". Using a classic VRP, "cities" are defined by "customers," and a legislator visits some of them. An evidence of a classic VRP is shown in Figure 2.1. To win the election, the goal is to select the most appropriate route within the constraints of budget and distance. It is possible to classify our problem as a classic ARP in this form.

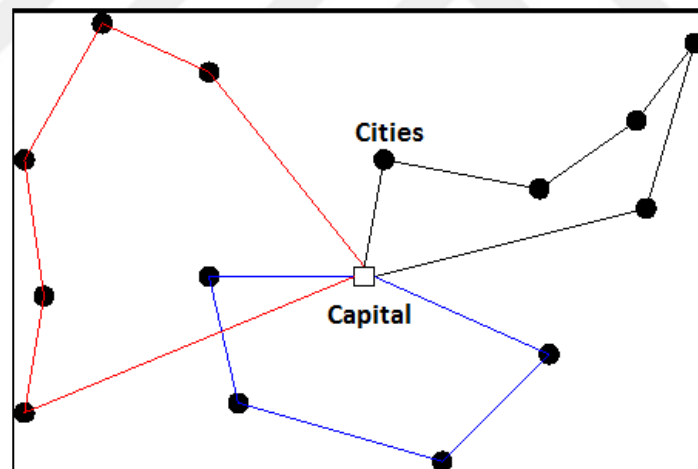


Figure 2.5: explaining ARP between cities and capital [52].

ARP generalizes the well-known dilemma of the traveling salesman (TSP). The goal of TSP is to find a path plausible when a set of shoppers (cities) must be visited only once and the loop must be completed at the beginning of the journey. PC-TSPs, TSPs with service times, multiple TSPs, and other variations all fall under the TSP umbrella. As in PC-TSP, a politician must visit as many

cities as possible in order to collect the most votes (prizes). In the following section, we'll take a look at some common PC-TSP issues..

2.4 INTERNATIONAL TRAVELING SALESMEN PRIZE COLLECTION CONCERN (PC-TSP)

Traveling as much as possible for the sake of collecting the most votes (in the situational prize) is the only way to avoid a loss in votes. Because of time and budget constraints, however, some cities may be skipped by the politician in order to focus on his/her campaign, even though he/she will face a penalty for doing so. However, this decision is made based on the city's relative voter turnout. A typical PC-TSP, whose core idea is comprehensively explained by research teams in [53], has many constraints that are very similar to those of our problem.

PC-TSP studies in the literature include a wide range of applications, such as the traveling tournament problem, where the goal is to optimize sports scheduling [54]. They developed an algorithm based on the PC-TSP integer formulation and found it to be extremely effective when applied to the Kidney Bundled Donation Program by researchers in [55]. Researchers in [56] used a parallel heuristic initiated into a multi-start algorithm to approach a ARP that carrier and delivery occur simultaneously. To get around this issue, researchers in [57] came up with the tabu search algorithm. To find a better solution, a metaheuristic method known as tabu search employs iterative movement patterns to nearby neighbors, taking its most recent alternatives as tabus to prevent any further movement. As a result, this procedure proved to be more efficient than more complicated methods such as cluster search when dealing with large datasets.

Additive bounding strategies were used by researchers in [58] to compute every possible bounding procedure and then use only one as the new lower bound for the prize to be collected. Using the branch and bound algorithm, they were able to zero in on the best solution. It was also proposed that the binary bayesian approach could be used to solve the problem of a factory needing the peak supply possible from with a set of suppliers. This algorithm relies primarily on an algorithm or a rounding method for the relaxation of fractional solutions to integers, which was developed by researchers in [59]. A hybrid algorithm called known as Genetic algorithm Clustering Search was used by researchers in [60].

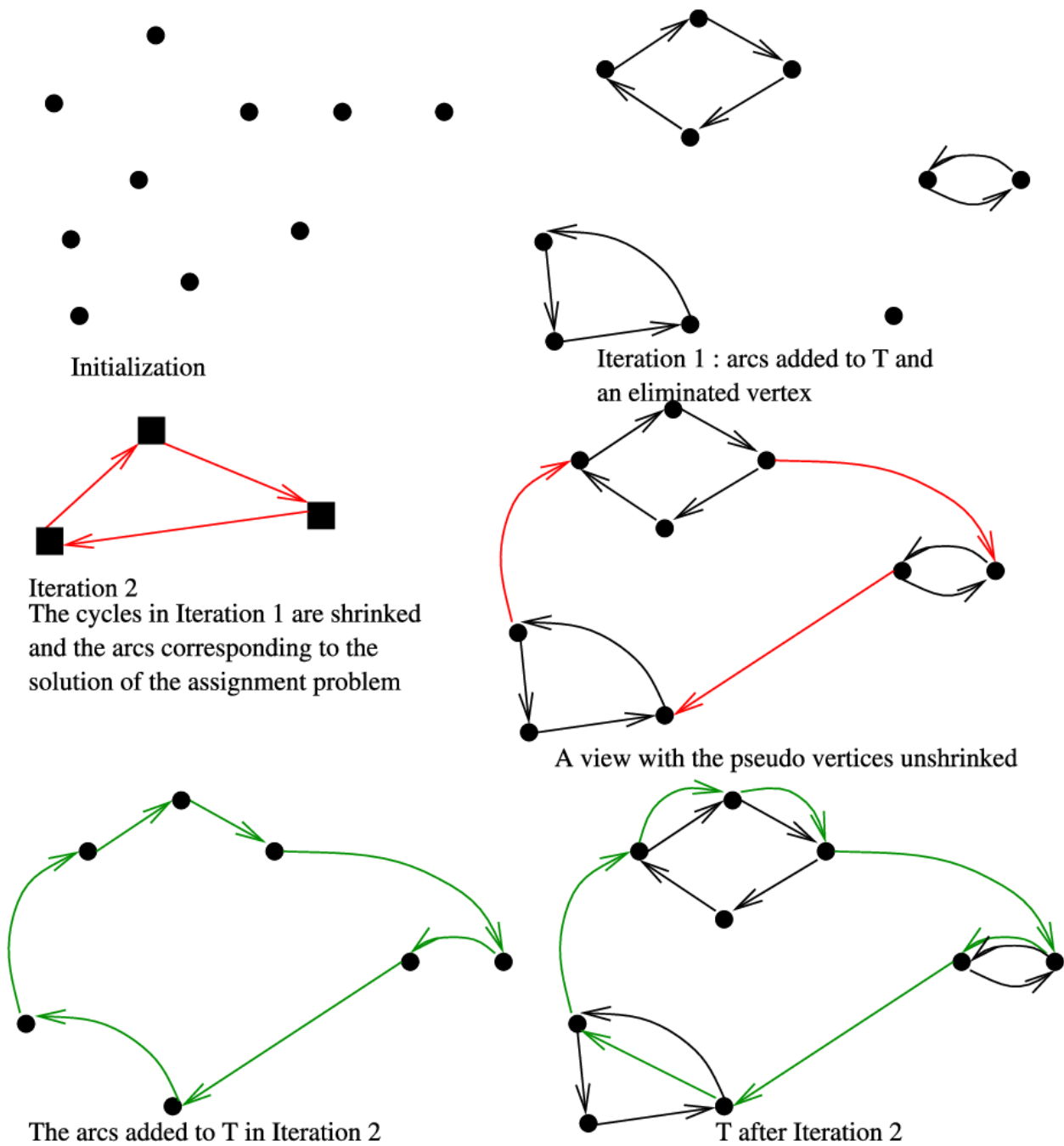


Figure 2.6: Conceptual illustration of prize-collecting traveling salesmen problem [61].

There is a problem with a repairman's list of jobs, each with different locations and unique time constraints, that researchers in [62] attempted to solve. Finding the most profitable schedule for a

company was the goal of this study. They built two models: one for job vacancies that had release dates and deadlines but no processing time; the other for jobs that required processing time. As a result, a ‘ due was devised. An additional density factor was invented to limit the number of "zigzags" between job locations in the second model.

2.5 POLITICAL COMMUNICATION AND ACTIVITIES

According to this study [63], one method of human communication is analysis, which is used to explain concepts and express emotions and thoughts. In addition to being used to give orders, it also serves as a means of clarifying what is being said. The different versions and sorts of succession that can be detected are limited by the lower precision of these devices compared to camera-based ones. However, they are preferred bar stools . kitchen active devices because participants can be used in low-light environments and because they don't require the user to carry or touch a device. When we're talking, we often use body language to convey a variety of emotions and ideas: pointing at someone else, saying "stop," expressing frustration or joy, and so on. Movements that have interpretation and express thoughts are known as political optimizer. There are a variety of uses for series recognition, including ways to communicate for type of hearing disabilities, children's interaction with computers, and more.

Using active devices necessitates physical interaction with the transceiver module, which necessitates training and does not occur naturally when communicating in series, as researchers found in this paper [64]. Active devices include the data glove and accelerometers. Sensors in compute nodes provide extremely accurate measurements of range. Consequently, these devices are pricey. Active devices have a high degree of precision and high efficiency, but they can be a pain to use because they require intimate contact between it user and the tool. Compared to active devices, passive devices are more user-friendly because they don't necessitate any physical contact. It is possible to track a user's natural movements without requiring them to wear or hold a sensor using passive approaches. According to [65], camera-based algorithms are an example of a passive-based technique. Camera-based approaches necessitate that the object be placed in a well-lit area. Using video cameras, camera-based devices capture the time-motion data needed for analysis. Frame by frame, this video is decomposed into a series of features. Using this type of

modulation, the frequency of the signal changes linearly over time. Politics is the most common term, but if this happens more frequently it's known as image un-scale. Imaging scale refers to a decrease in frequency. There are numerous advantages to employing this signal type in series recognition applications. First and foremost, they take advantage of channel space. Because of their high time-resolution capabilities, rangers are an excellent choice in this area as well. To be near to an impulse, as described in [66], we require that our political signal have a short duration. A political signal seems to have the same frequency and phase components as an impulse, but with a different amplitude and phase transfer. Filtering can also be used to remove unnecessary limbs and unrelated objects. Then, in each frame, the time's posture is determined. We can classify a series based on the pattern of time yoga poses and the training of a classifier for the type of flow postures that are associated with each series.

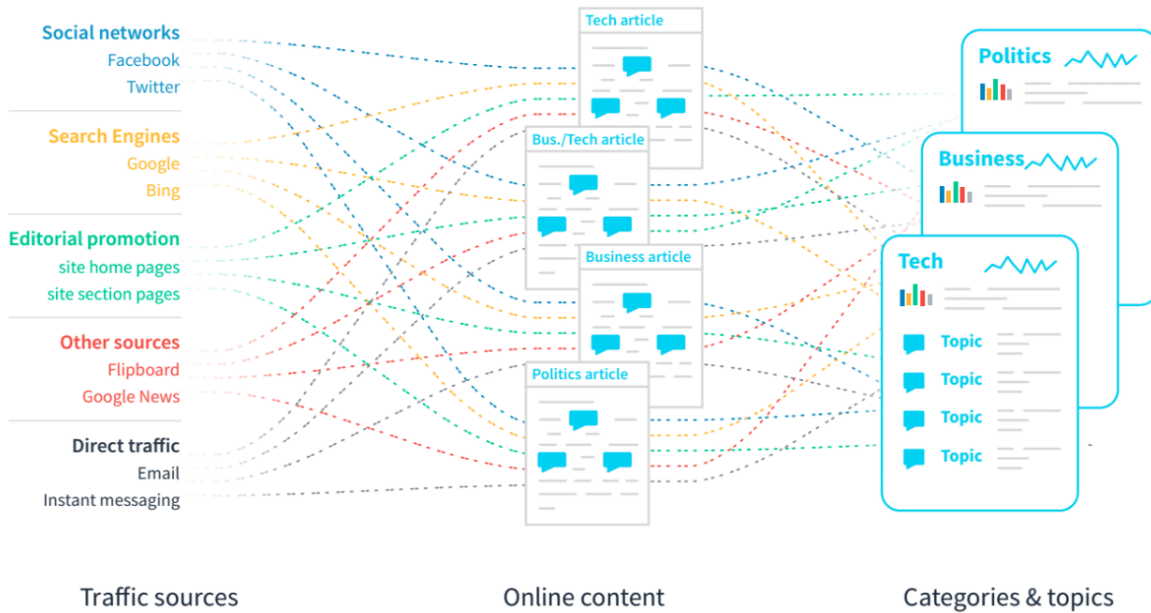


Figure 2.7: The types of communication in different types of domains based on articles [66].

Since governmental carrier frequency is used to generate the political signal, the researches are focused on this paper [67]. Using this type of modulation, the frequency of the signals linearly over time. When the frequency increases, this is referred to as political imaging; on the other hand,

when the frequency decreases, this is referred to as series imaging. There are numerous advantages to employing this signal type in series recognition applications. First and foremost, they take advantage of channel space. Because of their high time-resolution capabilities, rangers are an excellent choice in this area as well. As a general rule, we want our political sensor to be short-lived, and thus more like an impulse. A electoral signal does have the same frequency and phase components as an impulse, but with a different amplitude and phase distribution. In addition, low computational complexity is required in some applications. However, it provides a better estimate of the range. According to [68], linear carrier frequency is used to generate the political signal. Using this type of modulation, the frequency of the signal changes linearly over time. We also need a strong signal (high signal-to-noise ratio) so that we can see the reflected signal's characteristics and tell it apart from the campaign.

3. METHODOLOGY

In a political campaign, reaching as many people as possible in the shortest amount of time and with the least amount of money is the goal. Mass meetings and advertising are two of the most common ways campaigns interact with their constituents and keep their message in front of them on a regular basis. It's all about getting the best possible promotional effect based on previous elections.

In this paper, we devise a method for allocating convention and ad budgets in the highly useful way possible. Budget allotments for this purpose will be compared in order to find the best possible allocation. Additionally, we propose route to perform mass group meeting and the best cities to advertise under period and budget limitations. As a result, the model prioritises cities that are most likely to benefit from the campaigner's efforts. Our study differs from others in the field because it tackles both the route and supply chain issues at the same time.

An American case has also been examined in this work. The Supreme Electoral Council limits the length of exposure can result in American research, despite the fact that they may vary (YSK). Politicians typically begin their campaigns in Houston, the state's capital, and travel to at most two separate election regions on the same day, holding campaign meetings along the way. Each campaign day is assumed to begin with a departing trip from Houston and ending with an arrival back in Houston. Campaigning days need not be consecutive, and the prime objective is to get the most votes possible within the constraints outlined above.

Since politicians are assumed to be unaffected by the strategies of their rivals, this model assumes there is no competitive pressure between them. The only goal is to get as many votes as possible via executing a plan that maximizes plan distribution amongst advertising and convention fees while in addition providing the finest path to go behind for a bulk conference run. Iteratively solving a problem in this way, which stores data of each step and compares it to previous solutions, is the approach we propose as a solution method. This model breaks down the problem into smaller subproblems for each time period.

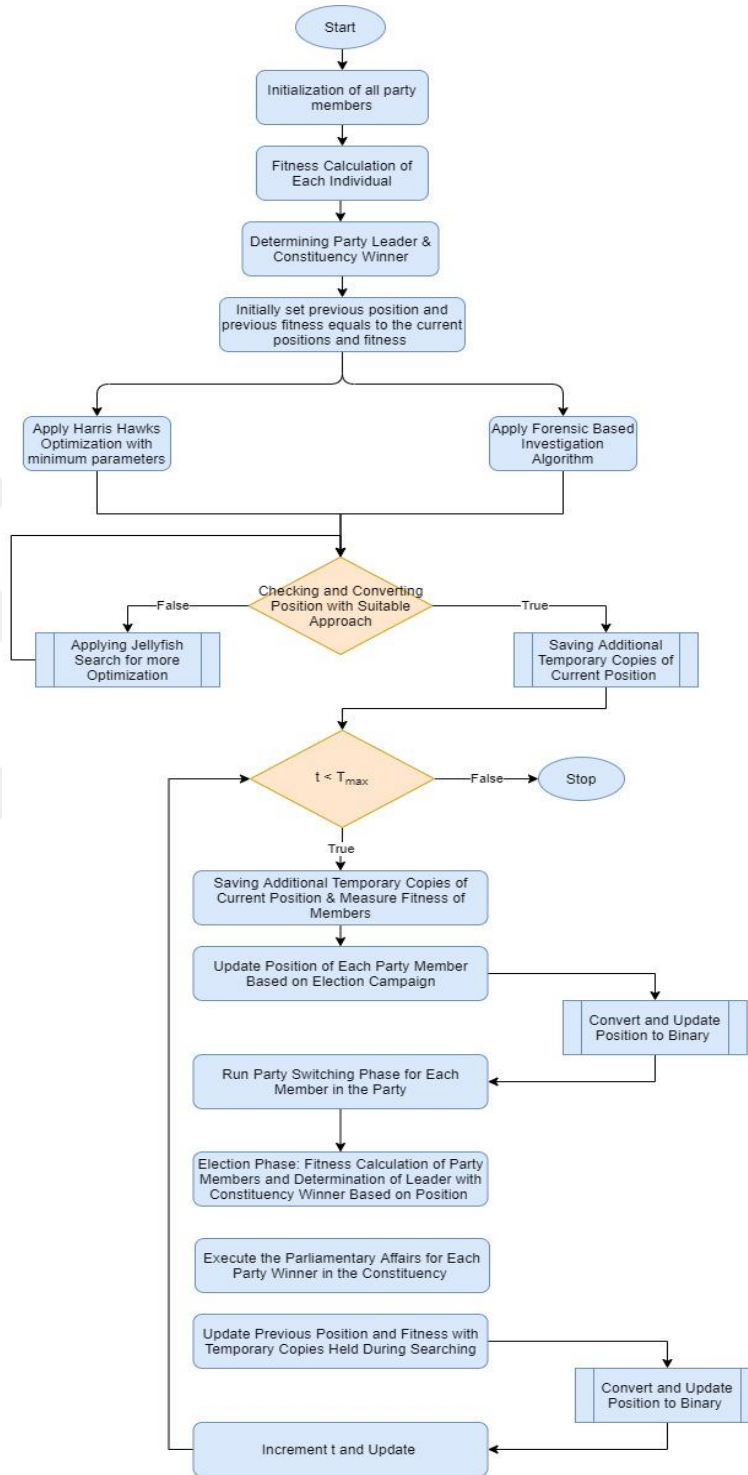


Figure 3.1: The flowchart of approach being followed.

3.1 FITNESS CALCULATION AND MODELING

Based on a tight budget, a new type of time- and space-restricted campaign routing concern is outlined. As a result, the problem can be categorized as a Harris Hawk algorithm with a single objective, multiple periods, dynamic behavior, and a time limit. The optimization technique controls the finest budgetary control choice for apiece movement, with town hall conferences, all sorts to ad campaigns; a competitive intelligence of towns for each advertisement giving to the distribution of funds choices, a sequence of towns for town hall conferences on every time historical to optimize the candidacy consequence over the preparation historical for a campaign.

For each city, the political party's percentage of the vote, the population eligible to vote in that city, the campaign costs associated with each type of campaign, and a distance matrix are all included in the model's parameters. As a result of this process, a variety of budget allocations are generated. x percent of the total finances should really be spent on advertising, and $(100-x)$ percent should really be spent on gatherings, where $0 \leq x \leq 100$. Budget allocation that enhances the number of votes is provided by this model.

Fundamental Statements:

1. The goal is to collect as many votes (total reward) as possible even during campaign period for the candidate.
2. There isn't anyone else out there. In light of our limited resources, we are only interested in the impact of campaign allocation on voter turnout.
3. Between the political rallies and other advertisements, national budget scenarios are generated.
4. The contender receives the vote since for each town they visit.
5. In order to determine the reward function for a specific city on a specific day, we need to know two things:
 - a) Voter turnout in the city; party vote share in the city;

b) Voter turnout in the city; party vote share in the city; and other relevant factors

7. Cities with differing election results (prior election voter gain as percentage) might be employed in this model. Campaigning in any city can help candidates obtain votes. Canvassing in a town is a fabrication event in this paradigm. For each part of expenditure ensures a particular number of votes. In our model, marketing in a city has no negative influence on results since we only look at budget effects, not every element. The aforementioned two notions are critical to grasping and determining the campaign approach in this work.

8. The promotion dates are well-known instead of the battle policy.

9. Due to distance and funding, candidates can only visit two cities per campaign day.

10. Not all cities must be visited. Budget and distance limits dictate which cities are visited.

11. Candidate spends less money on ads in cities that yield more advantage (votes).

12. Meeting costs and budgets are the same for all cities, however advertising expenditures are proportional to population.

13. On each campaign day, any candidate may travel no more than 100 km.

14. On each marketing day, the length between cities could be less than a kilometer.

15. A gathering or ad can only be held if the budget allows it.

The mathematical model is predicated on the assumption that each city is allocated a specific advertising budget. The money that is allocated can be based on the residents of the state, can be equal with each city, or can be a combination of the two. The mathematical formalism is built on the basis of these assumptions, and the model footnotes that are employed in this optimization are as follows.

3.2 DATASET DESCRIPTION

In a dataset, each array represents a new observation, and each section offers a new variable. This data can be either qualitative (categorical) such as votes, city, party; or quantitative (numeric) such as the winning streak in the particular city or area. Again, and as said before depending on the type of data the approach used to the analysis may vary, because is no treated the same way numeric and categorical data. a dataset holds been obtained as of the free-source report: https://o.nsd.no/european_election_database/country/USA/parties.html. The size of this dataset is relatively manageable due to mainly three facts.

- The number of cities that are a small amount accounting for different sub-broadband networks for parties during election.
- The measurements period is in most of the votes around year length in the cities.
- The data was aggregated during the election, fact that reduced the final number of observations and therefore the dataset's size in the year of 2011.
- The fitness of party and the member consumption data for general voting election.
- Determination of party information based on measured votes and regions.

3.3 HARRIS HAWK AND JELLYFISH OPTIMIZATION

As a solution to this difficulty, we suggest a new sort of searching optimization based on the Harris Hawk modeling, which is particularly useful when dealing with problems that are composed of numerous interconnected smaller subproblems. In this procedure, a scientific process is offered to defining the general optimum answer to a set of secondary-decisions that are combined together. After segmenting the problem down into smaller parts, dynamic programming begins to attack the problem (stages). When the optimal solution is found for either the final or first subproblem, the algorithm extends the problem step by step until it has solved the problem as a whole. As can be seen, it can sometimes be a bottom-up technique and sometimes a top-down strategy that is used to construct a later stage optimum on the foundation of a previous stage optimal. In this case, the concept is straightforward: simply save the data from previously solved subproblem and utilize it

as a reference in the future in the following subproblem. Because this method saves the outcomes from each step, the computing time is significantly decreased; however, the period investments at the cost to increased memorial utilization. In computing, the development of retaining records is referred to as memorizing, and it is a unique property that is not used in comprehensive enumeration methods. Furthermore, in contrast to linear programming, there is no one typical formulation of a problem in dynamic programming language, such as any can alter equalities to match the places varying on the extent of one's previous experience to static programming applications.

Although jellyfish is an extremely successful solution approach for optimization issues in money matters, mathematics, pc science, and executives arts, it can barely be employed to situations thsat match a specific set of conditions. These criteria include the following: For a problem to be classified as a nonlinear control problem, the fundamental structure of something like the problem must exhibit the criteria listed below:

1. It should be possible to break down the problem into steps.

Dynamic programming problems are stated to have the most noteworthy attribute when they can be broken into simpler stages that, when handled consecutively, result in a general explanation to the complete trouble. These 1-step cleaner kinds of troubles sare handled in the same way as other optimization problems, and each response in the series contributes to the determination of the features of the next one-stage problem.

Since the vast majority of time optimization issues require the use of several timeframes to make sub choices based on data, the stages in the model can be used to represent the various time periods. There are some other issues with it, such as the fact that the stages can really be construed in relation to time. It is still possible to express this sort of troubles as a dynamic program, but it takes more understanding and insights of spot them. Into our case, the steps are represented by the time intervals t , which are referred to as promotion preparing periods in the context of the jellyfish optimization technique.

2. During this time frame, many actions are taken.

In our problem, the action indicates the amount of money that will be allocated to each campaign. The following actions are generated in a systematic manner and displayed:

$$a = [a_1, a_2]$$

a_1 & a_2 are the reasonable provision rates to advertising and conference, respectively. During the analysis, discovered eight potential budget allocation options for meetings and advertising, resulting in eight different cities and routes, from which the model would choose the one with the most support based on a comparison of the findings. As may be deduced, the first thing to do throughout the campaign period is a . As a result, this action is executed throughout the marketing duration without regard to time t .

The most effective path to take $a^* = [a_1^*, a_2^*]$ is chosen based on the total number of votes received from the various budget allocation alternatives.

3. Each stage has a predetermined or innumerable quantity of nations.

To each stage of the question relates to a finite number of possible states. Information about future consequences of the current choice is provided by the states.

Dynamic programming design relies heavily on the detection of the problem states. It is usually acknowledged like art form that necessitates a great level of originality combined with acute perception of the trouble. State selection is influenced by several factors, including.

- i. There is no need to know how the organization got to the current position in order to make future judgments.
- ii. There should be no more than an acceptable number of states each stage, otherwise the computing effort would be too expensive and the stage would lose its efficiency. ii. There's a limitation to how well dynamic programming approaches work in real-world situations.

St's exist the towns in our model that want also be go to at the moment in time t. The system selects the town with a greatest number of votes from the other cities in accordance with the constraints.

4. There is a change from one state to the next at each stage t.

Budget allocation rate variations for each campaign make up the action 'a' in our model, and these are randomly picked. The algorithm chooses the cities with the greatest vote totals after performing action 'a,' which includes calculating how much money should be spent on meeting preparations. At the conclusion of each period, the funding is reduced, and the city with the most remaining benefit is chosen as the new S_{t+1} city. In this case, the initial action 'a' has a serious influence on this transition. Being within next phase during time t+1 is advantageous.

$$\begin{aligned} v_{t+1}(S_{t+1}) &= \max_{a \in A} [C(S_{t+1}, a) + v_t(S_t)] \\ S_{t+1} &= f_t(S_t, a) \end{aligned} \quad (3.1)$$

Transition function is defined as: $f_t(.)$, while immediate contribution is defined as: $C(.)$.

A left-to-right-hand flow involves that the goal exists to move from one government to another, as shown above. Future states are created when we act. As a result, a stochastic optimization trouble tin can be conceptualized like a net, with each point contributing to the optimal solution in some immediate way.

Policy prescriptions are provided in different cases, as well.

For each stage, dynamic programming provides alternative solutions in the event that the overall optimization algorithm cannot be followed due to an unforeseen event. To perform a sensitivity analysis with greater freedom, you can use a feature called policy prescription.

The principle of optimal solutions in nonlinear control difficulties involves that the optimum for subsequent steps be separate of the optimum for earlier steps.

$$v_{t+1}(S_{t+1}) = \max_{a \in A} [C(S_{t+1}, a) + v_t(S_t)] \quad (3.2)$$

We can see from the equation above that the next move can't be limited by the previous optimal given the current state. All values are then compared to determine which ones are the best, armed with the knowledge of the preceding stage's optimal value. It's called Harris Hawk Property, and dynamic programming won't work if a problem doesn't meet this requirement.

7. Initiating a solution procedure from either the final or first stage is possible.

$$v_t(S_t) = \max_{a \in A} [C(S_t, a) + v_t(S_t)]$$

$$S_{t+1} = f_t(S_t, a) \quad (3.3)$$

Both forward and back induction are acceptable methods of reasoning. Even though we conducted this study by using forward induction, we might well however find the results even condition we treated retrograde induction in the same way.

8. It's possible to derive the optimal rule meant for phase t+1 first after most favorable policy for show t because of the recursive nature of the relationship between the two stages.

Votes from cities that have been visited and also where advertisements have been placed are used to calculate the value for being in state S_{t+1} , $v_{t+1}(S_{t+1})$.

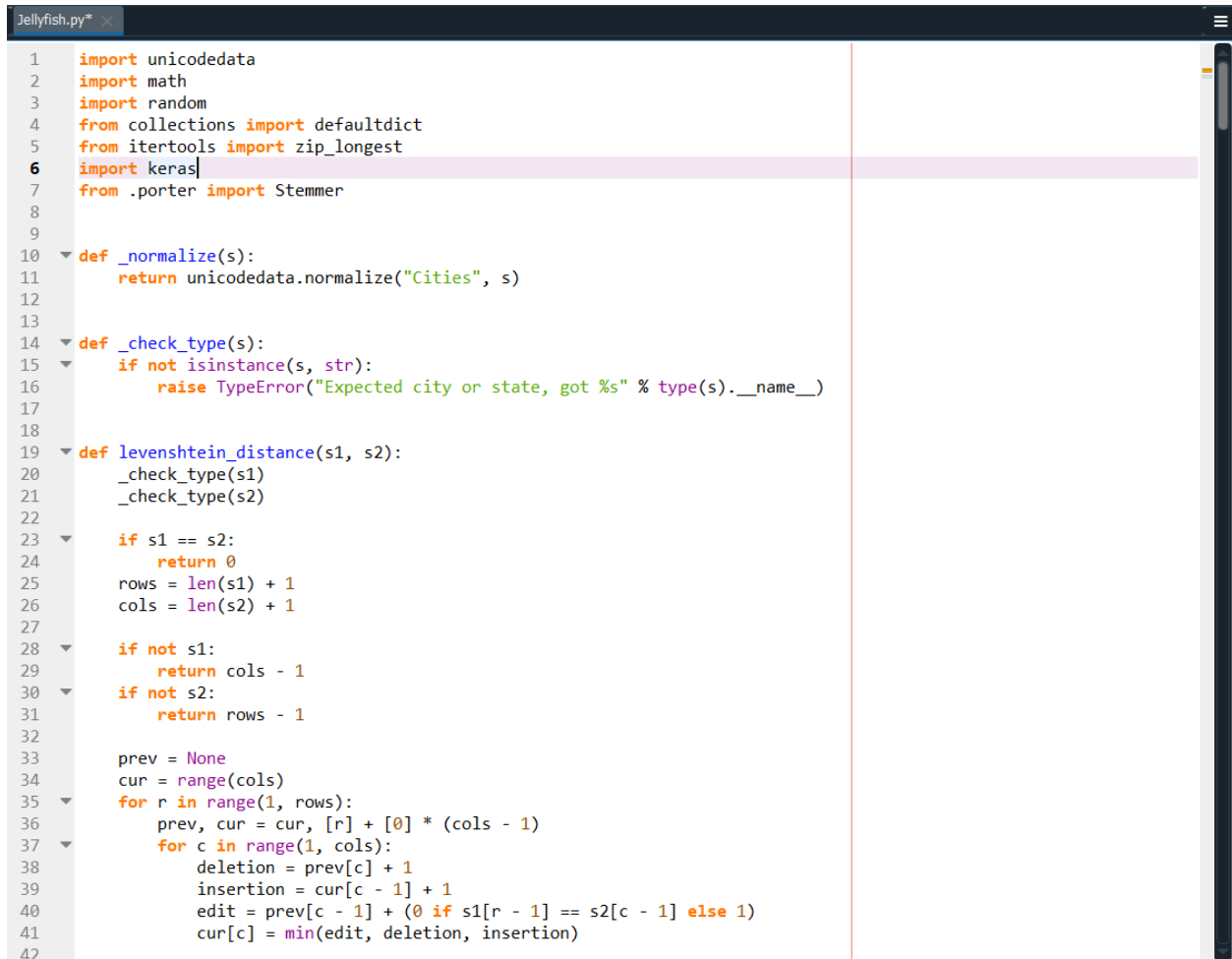
$$v_{t+1}(S_{t+1}) = \max_{a \in A} [C(S_{t+1}, a) + v_t(S_t)], \quad t = 1, \dots, T \quad (3.4)$$

At the time of this writing, the instant benefit function $C(S_{t+1} | S_t, a)$ defines the amount of elects procured since nation S_{t+1} when it journeys from public S_t below legal action a .

A^* , which is the distribution of funds circumstance that receives the most votes, was chosen as a final decision because it maximizes the value function. Distribution of funds decision a^* dictates the cities in which advertising and mass meetings are to take place.

The Harris Hawk methodology can be broken down into two categories: deterministic and probabilistic. There is a probability distribution for what the next state will be in problems involving probabilistic dynamic programming; however, the supply is however entirely affected via an actual public and judgement. This means that the situation at the next point is not just

dependent on the modern public and judgement. To solve our problem, we used deterministic dynamic programming, which is a type of dynamic programming.

A screenshot of a code editor window titled 'Jellyfish.py*'. The code is written in Python and implements the Jellyfish optimization algorithm. It includes imports for unicodedata, math, random, defaultdict, zip_longest, keras, and Stemmer. The code defines three functions: _normalize(s), _check_type(s), and levenshtein_distance(s1, s2). The levenshtein_distance function uses a dynamic programming approach with a grid to calculate the distance between two strings. The code is as follows:

```
1 import unicodedata
2 import math
3 import random
4 from collections import defaultdict
5 from itertools import zip_longest
6 import keras
7 from .porter import Stemmer
8
9
10 def _normalize(s):
11     return unicodedata.normalize("Cities", s)
12
13
14 def _check_type(s):
15     if not isinstance(s, str):
16         raise TypeError("Expected city or state, got %s" % type(s).__name__)
17
18
19 def levenshtein_distance(s1, s2):
20     _check_type(s1)
21     _check_type(s2)
22
23     if s1 == s2:
24         return 0
25     rows = len(s1) + 1
26     cols = len(s2) + 1
27
28     if not s1:
29         return cols - 1
30     if not s2:
31         return rows - 1
32
33     prev = None
34     cur = range(cols)
35     for r in range(1, rows):
36         prev, cur = cur, [r] + [0] * (cols - 1)
37         for c in range(1, cols):
38             deletion = prev[c] + 1
39             insertion = cur[c - 1] + 1
40             edit = prev[c - 1] + (0 if s1[r - 1] == s2[c - 1] else 1)
41             cur[c] = min(edit, deletion, insertion)
42
```

Figure 3.2: The Jellyfish optimization algorithm implementation.

```

Harris_Hawk.py
1  import numpy as np
2  import math
3  import random
4  import matplotlib.pyplot as plt
5
6  def initializer(N, dim, up, down):
7
8      x = np.random.rand(N, dim)
9      x = np.multiply(x, up-down)+down
10
11     return x
12
13 def fobj(x):
14     dim=x.shape[0]
15     o=100*(np.power(x[1:dim]-np.power(x[0:dim-1],2),2))+np.power(x[0:dim-1]-1,2)
16     return sum(o)
17
18 def Levy(d):
19     beta=1.5
20     sigma=(math.gamma(1+beta)*math.sin(math.pi*beta/2))/(math.gamma((1+beta)/2)*beta**((beta-1)/2)**(1/beta);
21     u=np.random.randn(1,d)*sigma
22     v=np.random.randn(1,d)
23     step=np.divide(u,np.power(abs(v),(1/beta)))
24     o=step
25     return o
26
27
28
29 def HHO(N,T,lb,ub,dim):
30     print("Optimization is underway")
31     Rabbit_Location =np.zeros(dim)
32     Rabbit_Energy = math.inf
33
34     X0 = initializer(N,dim,ub,lb)
35     CNVG = np.zeros(T,dtype=int)
36     q=0
37     t=0
38     point=[]
39
40     while(t<T):
41         fu=np.zeros((X0.shape[0],X0.shape[1]),dtype=int)

```

Figure 3.3: The Harris Hawk optimization algorithm implementation.

3.4 VOTING OPTIMIZATION BY STATES

In this section, the implementation of Harris Hawk and Jellyfish into deterministic voting problems for social group optimization is presented in part. Deterministic voting problems are those in which the later public is resolved solely by the recent condition S_t and the statement judgment a .

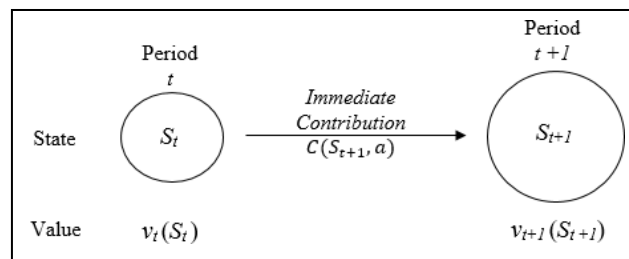


Figure 3.4: Deterministic active molding background for Harris Hawk and Jellyfish optimization.

As a result, the state is S_t at this point. $t+1$ is the stage at which the political decision a shifts S_{t+1} from S_t to S_{t+1} . State S_{t+1} 's initial cost (or reward) play a role at $t+1$ as well as the functional form procured from S_t at t combine to form the utility function at $t+1$. For each subsequent stage of computation, we must first determine the weighted linear $v_t(S_t)$ for the previous stage. $C(S_{t+1}, a)$ would also be made at stage $t+1$ by the action a 's side. $v_{t+1}(S_{t+1})$ is gained by properly combining these two and moving on to the next step. As a result, the function is streamlined to focus on action 'a', which provides the most votes.

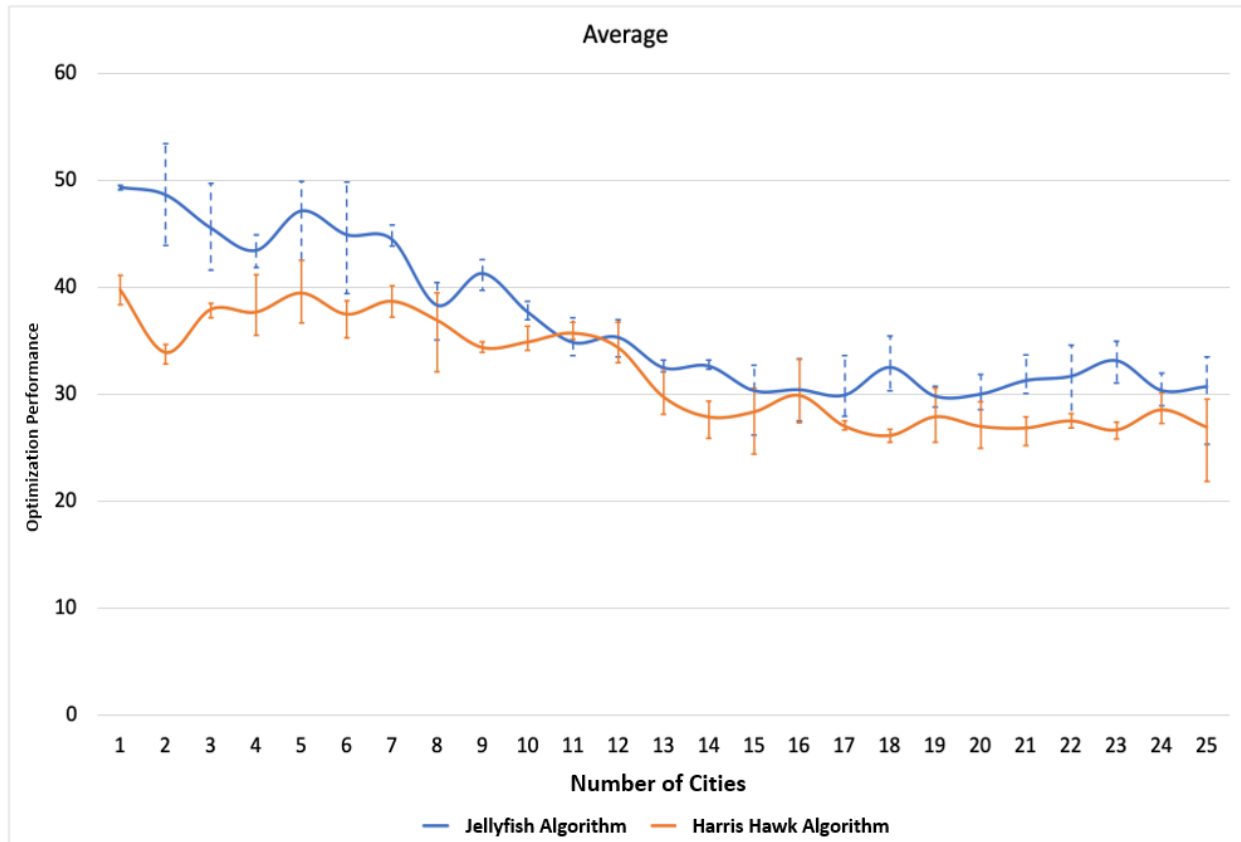


Figure 3.5: The comparison between the performance of voting optimization between Harris Hawk and Jellyfish technique.

In our model, now next state is determined entirely by the present condition and the existing regulatory judgment to use the Harris Hawk. So knowable jellyfish optimization is the solution to our problem. The objective function structure distinguishes Harris hawk but instead jellyfish programs. They usually aim to mini a sum of individual stage contributions or max a total of

personal stage contributions or mini a create. The nature of the states in stages can also help determine Harris hawk and jellyfish optimization. They can be allowed to treat as deterministic nonlinear control problems if they have discrete or continuous variable, or a state vector with multiple variables. Despite the apparent differences, the fundamental structure is largely the same.

3.5 POLITICAL OPTIMIZER (PO)

During elections, the Political Optimizer (PO) optimizes different perspectives. The PO tools utilize algorithms of provide especially exact span areas. This algorithm is both efficient and costly. The PO algorithm is accurate and simple, but it requires physical connection between the electorate and the political organization. Unlike election campaigns, the PO methodology is increasingly working but does not involve physical contact. This method tracks instinctual voter movement patterns without requiring subscribers to wear as well as hold any election-related demands. Famous passive based approaches include PO algorithms. When using PO-based methods, the voter must be in a party-neutral environment. The PO-based algorithm captures the voting motion using a predetermined election campaign. Then each vote is processed and broken down into a feature set. This type of modulation produces a signal whose frequency changes linearly with time. Vote up-scale occurs when the vote frequency increases. Vote down-scale occurs when the frequency decreases. This type of signal has many advantages in series recognition. They first use election channel. Second, their high time resolution makes them ideal for ranging applications. Generally, research requires a short signal to be pretty close to a voting impulse. It takes the like occurrence information in the same way as an impulse but not the same phase modules. The PO algorithm can also remove unrelated election parts. Then each election frame's time posture is determined. We can categories which collection was performed by having a look at the sequential manner of time postures and training a classifier about which series.

Political optimizer designation is expected in very much phones that do put up with low giving out authority, for that point going a spanning structure that needs small initial complexity exists ended up needing. There are limited methods to estimate a wireless channel's impulse response. This section presents a mathematical model for received signal response estimation method using political optimizer. The method is then used to estimate range for various movements. One method

for political integrator classification is to approximate the moving time range and the received vote strength. Time of flight could be used to estimate range in many ways. Voting can find series occurrence by measuring received signal strength. A series' type can be classified using range estimation. This approach is used in this study and shows excellent results with diplomatic optimizer. The voting contains a series of equal length hops by Americans. Each hop has voting preceded by a silent election. Votes associated with extremely weird indexes increase efficiency while votes linked with an even index decrease efficiency. The initial is increasing, the next is declining, and the third base is growing. This makes two election campaigns orthogonal. It uses less power than methods that rely on the PO algorithm. Using political campaign for series acknowledgment is faster than PO-based algorithms. It also ensures privacy during voting and is insensitive to ambient lighting. Many poor devices require political optimizer classification, so a low-cost ranging system is required. There are low-cost methods to estimate a PO channel's impulse response. This section presents the statistical equation for deep learning received signal response estimator. The method is then used to estimate range for various movements.

$$P = \{P_1, P_2, P_3, \dots, P_n\} \quad (3.5)$$

$$P = \{P_t^1, P_t^2, P_t^3, \dots, P_t^n\} \quad (3.6)$$

$$P = \{P_{i,1}^j, P_{i,2}^j, P_{i,3}^j, \dots, P_{i,d}^j\}^T \quad (3.7)$$

The 'P' stands for party members and is used to find the rate of ballots during the campaign. And 'T' is the total number of iteration as stated party members are required to all the suggestions to win, into our conditions, research wished the beat interval to be maximum. The PO algorithm makes the current heartbeat maximum for a political group equal to the previous pulse in order to allow for add'l voting during election period. In other words, the reflections from the past pulse won't have an effect on the expressions from the present beat because they're voting. This ensures that PO algorithm gets a necessary votes of win the next election. This issue can be solved by employing the PO algorithm waveform. In order to cover the election campaign, the PO algorithm has an improved dynamic range than other algorithms with a single frequency. Due to the fact that the energy is dispersed over a wider range of frequencies, they are also more resistant to noise.

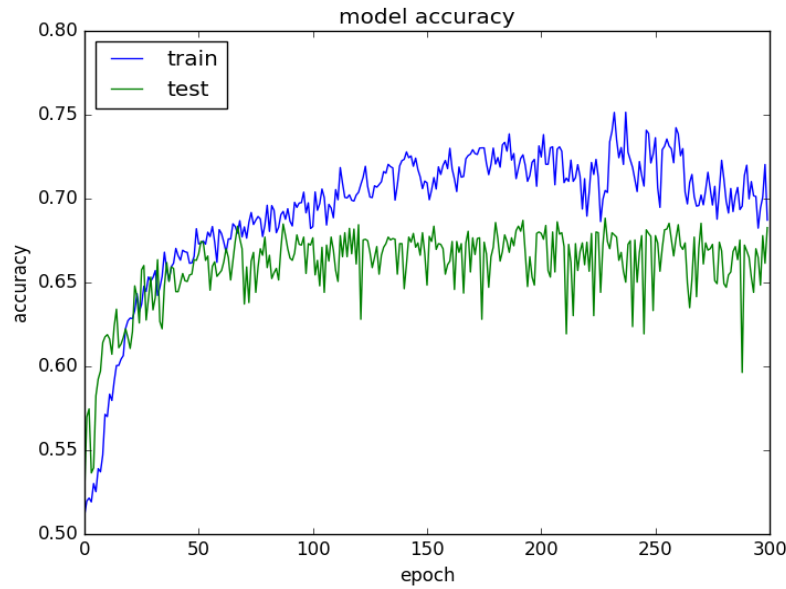


Figure 3.6: The training and testing of political optimizer algorithm.

As long as frequency and phase voting modulation has been used to produce general elections, the PO methodology has been in operation. Linearly increasing or decreasing frequencies can be generated by using this voting modulation. Voting with confidence is often referred to as "optimized voting," while voting with optimism with a decreasing frequency is referred to as "un-optimized voting with PO algorithm." There are numerous advantages to utilizing this type of technique in series recognition applications. First and foremost, they take advantage of channel space. Because of their high time-resolution capabilities, rangers are an excellent choice in this area as well. In order to get closer to an election, voting systems should be improved with the PO method to be as brief as possible. The frequency and phase components of a voting signal differ according to the political party manifesto, but they have the same basic structure as an impulse.

Generally speaking, party election networks tend to fit the data better than feedforward networks. Second, the plot indicates that networks which had layers retrained for ideological optimization had lower training damages than networks that had only one layer retrained. It is possible to fix this problem in a variety of ways. Data augmentation and the inclusion of occluded types of the

images in the training dataset are the simplest methods. Modular systems designed by machine learning engineers include more complex subsystems for segmentation, depth detection, and other political optimization tasks. Another option was to draw inspiration from optimization. As political studies have shown, the acknowledgment of partially occluded vote totals takes longer than the recognition of unobstructed election results. It is possible that a repeated coatings offer a extremely large examination space out, letting a simulations to around, thus losing a little reward that they would have on or after their element seek breathing space for politicians. Training assessments can be helpful in this regard; the monitoring that smaller standard failures are still correlated with an improvement in seeing at does not support the overfitting hypothesis. Consequently, these devices are pricey. Active voting requires physical contact here between voter and the political party, which can be uncomfortable for some voters due to the high efficiency and high complexity of active voting devices. Passive devices may be computationally taxing, but they don't necessitate direct physical contact, making them more conducive to political optimization than active devices. Political networks tend to better linear model than feedforward networks, as can be seen in general. Second, the plot shows that connections that already had layers retrained for democratic optimization had low variable losses than networks that had only one layer retrained.

4. RESULTS

For a study in the United States, we analyzed the results of the proposed model. Data on the United States has been gathered from a variety of supplies. We utilized data since the Ultimate Vote Commission to the United States to the group of constituencies in elections in every of the 21 towns we preferred to probe & the percentage of the democratic prior election's vote gain in that city. Using data from an open-source repository, the town distance matrix is generated. To get a sense of the real election environment, we chose 21 cities that were diverse in both location and population. We made certain, however, that the three major cities (New York, Houston, and Boston) were included because no politician might well take the risk of leaving them out. For the purposes of this study, the cities in were chosen based on their population size, the past vote gain percentage, and the proportion of voters in each city to the total amount of voters in that city. which is shown in Figure 4.2.

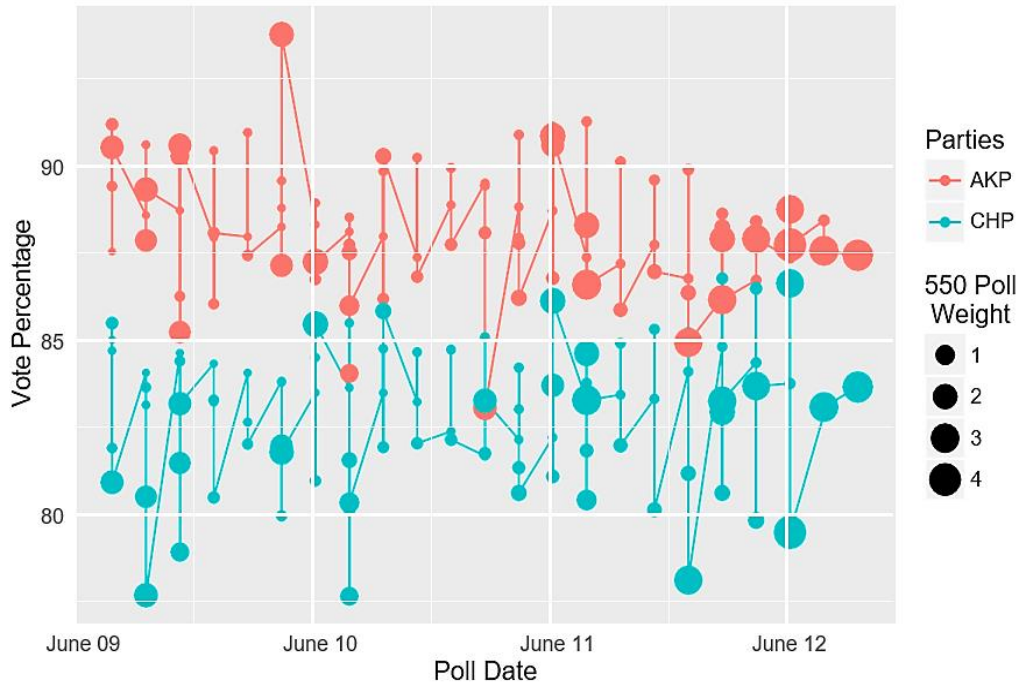


Figure 4.1: The poll weights between two major parties during election with vote percentage.

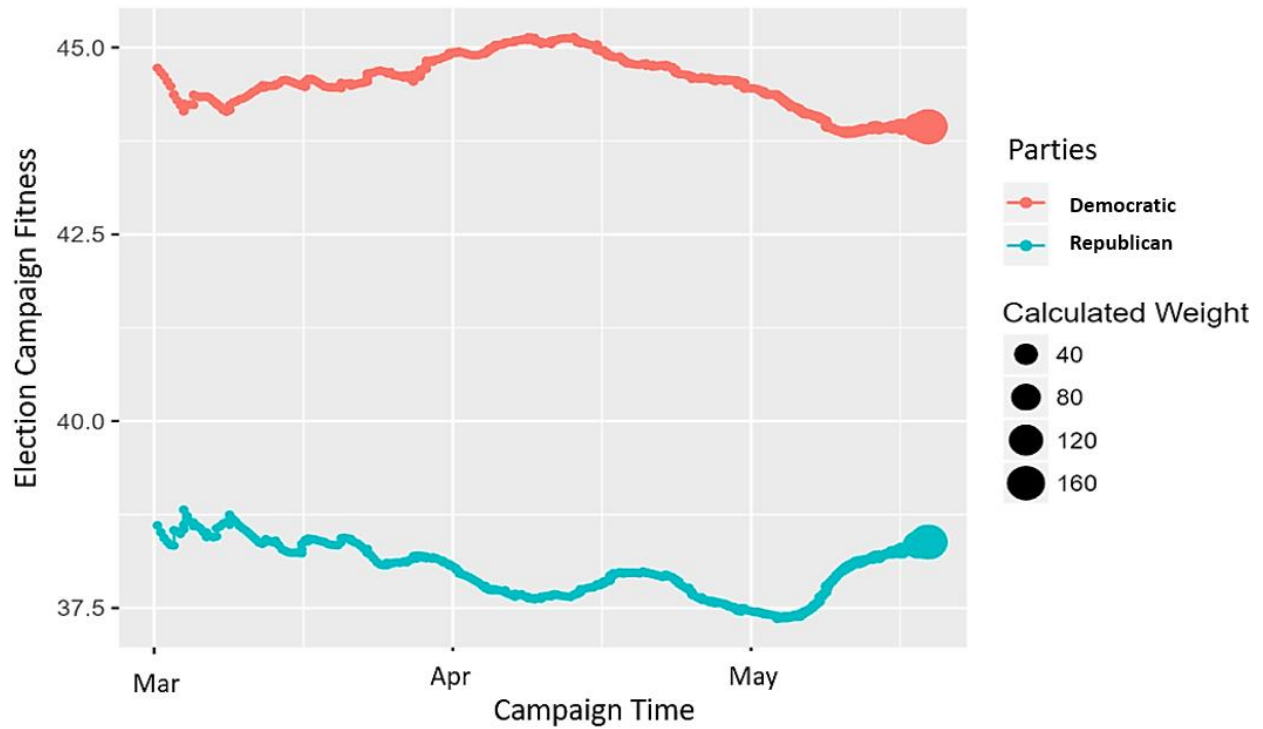


Figure 4.2: The fitness of election campaign between two major parties with calculated weights.

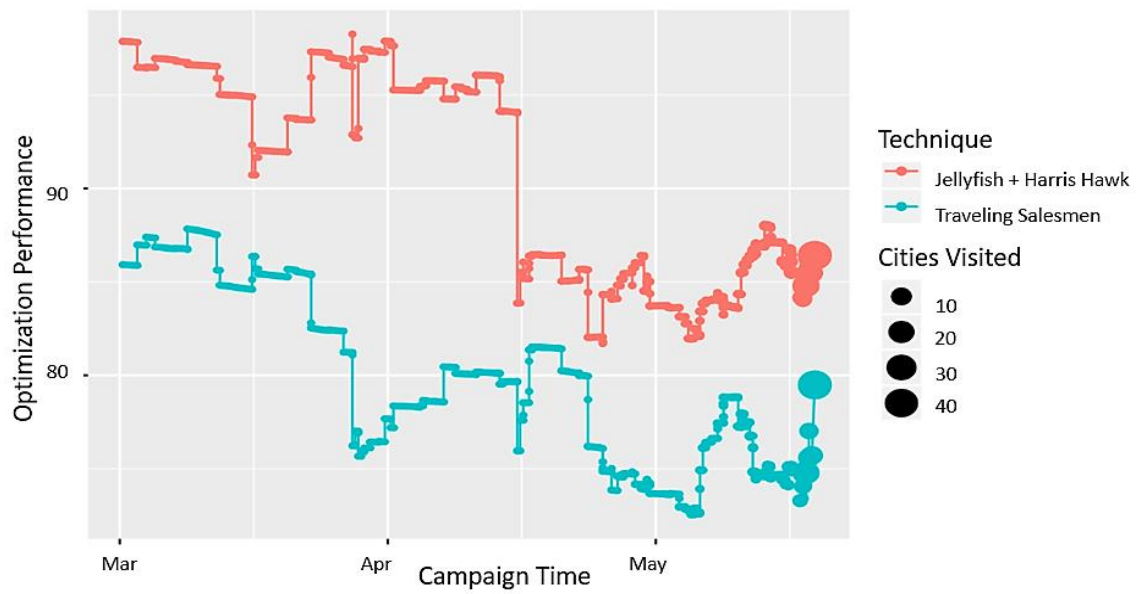


Figure 4.3: The optimization performance of TSP and Benchmark model with number of cities visited.

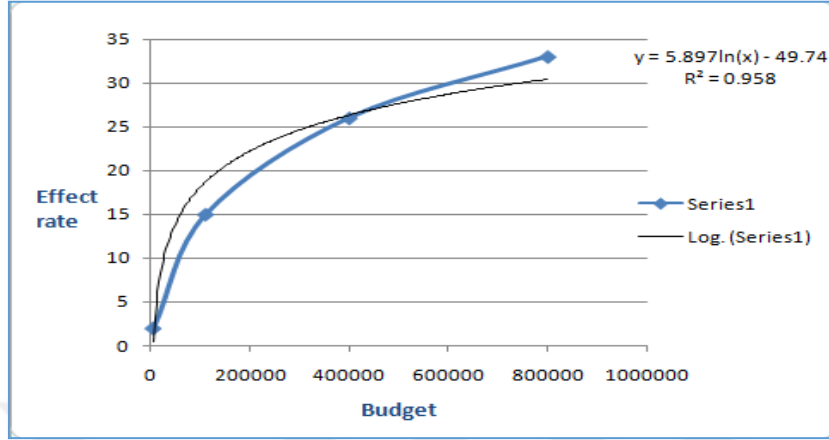


Figure 4.4: The outcome rate occupation.

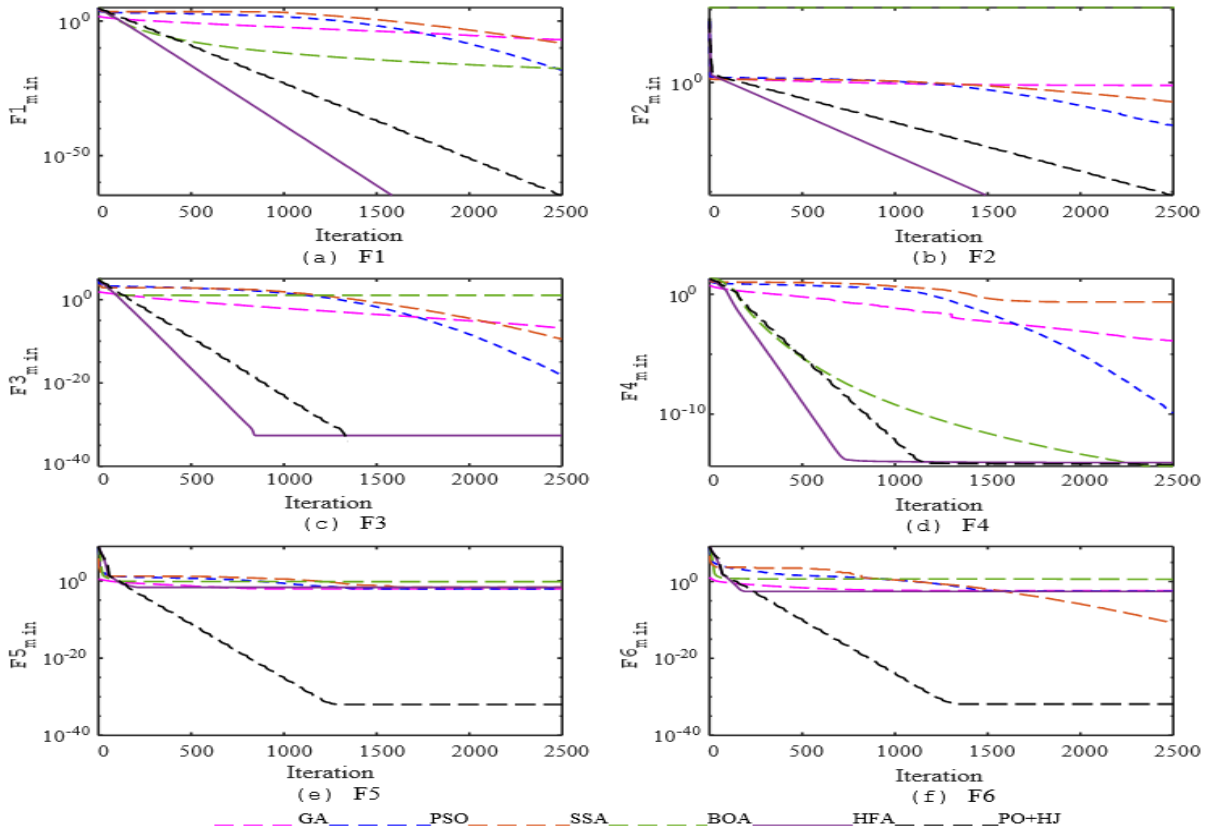


Figure 4.5: Computational results from function 1-6 for benchmark POHJ algorithm in comparison with existing heuristic algorithms.

The research observed that POHJ technique worked well for political optimization. This research provides the insight into political optimization with the recognition comparison of existing heuristic techniques. The political optimization recognition is very important have high accuracy and low complexity, but they can be uncomfortable since it needs physical contact between the voter and the political party function. While political optimization is computationally less demanding in conjunction with Harris Hawk and Jellyfish algorithm benchmark, they don't require physical contact, and they are friendly compared to active heuristic algorithms. The POHJ based approaches rely on tracking the natural voting movements without requiring voters to hold any campaign for general elections. A famous example of political optimizer plus Harris hawk techniques is optimization and heuristic-based algorithms. When using meta heuristic-based approaches i.e. POHJ, the time needs to be in a lightened environment for political optimization and social group optimization.

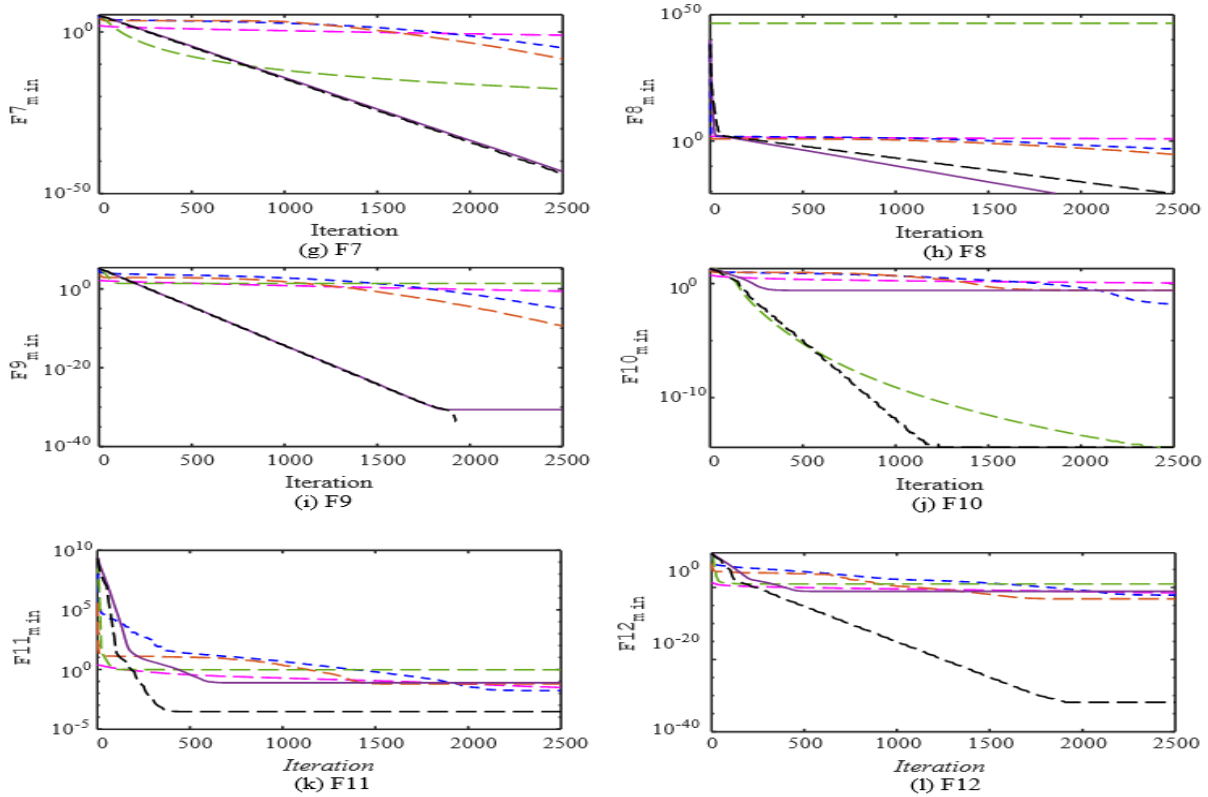


Figure 4.6: Computational results from function 1-6 for benchmark POHJ algorithm in comparison with existing heuristic algorithms.

According to the findings, 70% of the budget will be used for meeting activities, with the remaining 30% going toward advertising. Our predictions were confirmed by the data: In attempt to advance as many peoples in each city, we assumed that the advertising budget for each city would be proportional to the patient ratios of that city. However, the advertising costs are the same in all 21 cities. This means that each city must pay \$1,000,000 to launch advertising, but also more cash can be invested based on the population ratio of that city, or vice versa; if a city's ad budget calls for spending less than \$1,000,000, then no advertising is given to that city because the cost cannot be afforded. On either hand, for the meeting, we assumed that each city would have a budget of \$1,000,000 and that the expenses would be equal. As a result, each city's available meeting budget is determined by dividing meeting budget by the number of cities. Because large city squares are typically reserved for mass gatherings, the rental fee is assumed to be the same regardless of number of attendees. For this reason, cities with higher populations will still have network available effect rates and thus more people voting for the candidate, whereas cities with lower populations won't get ads because their allocated budget is less than the cost of attempting to launch an ad, \$1,000,000\$, which means they won't get any ads. As an illustration, multiplying the total advertising budget of \$9,300,000 by 0.0118 yields a budget of 109,740 dollars for Elazig, a town with a small population (population ratio). However, the model somehow doesn't select Elazig for advertising because the initial cost of launching an advertorial in any city is \$1,000,000, which is a cutoff value that helps the pressure group decide which cities are meaningful and which cities are not.

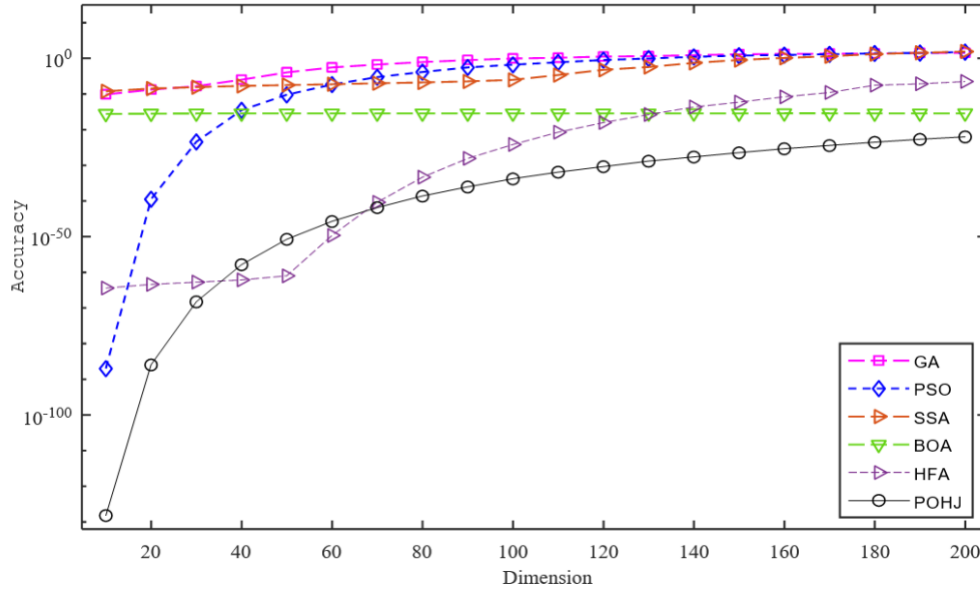


Figure 4.7: The dimensional political comparison between POHJ technique and different meta-heuristic algorithms.

The concept assigns 70% of the overall expenditure for the public meetings, which totals 21,700,000\$, and decides to travel to 16 cities. Normally, this sum would be sufficient to travel to all 21 cities, given that meetings in each city cost \$1,000,000 each. However, money isn't the only thing holding us back; we're also constrained by geographical distance, which means that certain cities go unexplored. Based on previous elections and the cumulative number of eligible voters in each city, the model suggests the cities that are most likely to vote in a mass meeting. It is possible to visit a second city during a campaign day if it meets the distance requirements, so long as the first city has been visited first.

The budget for this network is 75,000,000 dollars. A lot of communities in the network is the reason for this adjustment. There are 81 major cities in the United States, but only 50 are connected, and the DP budget for elections is approximately 118,000,000 dollars. According to the latest budget for 50 cities, the spending plan is slightly less than \$75,000,000. For this reason, our overall research budget of \$75,000,000 seems reasonable

5. CONCLUSION

Using a proportional electoral system, this study combined political campaign addressing and asset management optimization to produce a plausible campaign plan. There were two issues: 21 and 50 towns. To promote the hybrid model, many cities were chosen. The model provided mass meetings and a fitness-based campaign route. The findings allowed for city-to-city comparisons. Special advertising costs and budgets, provisional advertisements, but also campaign effectiveness rates were all subjected to a sensitivity analysis. To see cumulative impact, each section was scheduled in Python. Each analysis revealed a model's priorities and improvement areas. Simultaneously, partial advertising was Across all cities, TSP was 89.93 to almost, whereas POHJ was 98.57 to almost. In one scenario, the city of New York was refused a mass session due to a lack of funds. City whilst also city budgets were removed to improve the model. This is due to advertising length and travel time. The additional money is used for advertising. Finally, this model can assist advertising planners by providing holistic solutions.

5.1 FUTURE RECOMMENDATION

This section discusses possible research directions. Although the developed numerical method is suitable for large case studies, it could be improved to make it more accurate. In order to obtain more realistic results, the model can be updated to include actual campaign costs in each city. The model's validity is tested in various scenarios, but more precise data will yield better insights. Topics for research are discussed here. We believe the mathematical model can be improved for large-scale case reports. It is optional to include actual campaign expenditures for each city. This data verifies the model's authenticity.

the influence rate function was used to convert each city's budget to votes. we can dig deeper because both initiatives use the same function. this is used if more data exist. the function to make it this thesis recommends a 208-city campaign. using variables for budget planning is another improvement. historical election info can be collected to assess the model's validity. no sessions or ads in this section. cities' importance as advertising hubs divides politicians. this budget may be

included in some cities' mathematical models. timing is everything. in politics, this is used to save the most exciting events or rebuttals for last.



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