

Title: Using machine learning, identify potential societies for marketing the proactive healthcare product.

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

by

Shivam Singh Teotia

Under the Supervision and Guidance of

Mrs. Varsha Tanu

Associate Professor

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1st July 2022

To whomsoever it may concern

This is to certify that Mr Shivam Singh Teotia has successfully completed his internship from 21st March 2022 to 19th June 2022 with Seva at Home India Pvt. Ltd. During his internship he worked on Project “Using machine learning, identify potential societies for marketing the proactive healthcare product”.

He was found to be hardworking and sincere during this period. We wish him the very best in all his future endeavours.

For Seva at Home India Pvt. Ltd.

Ms. Bindiya Reddy

General Manager – Human Resources

DECLARATION

I hereby declare that this dissertation titled using machine learning, identify potential societies for marketing the proactive healthcare product is the Bonafede record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from other people's published or unpublished work has been properly acknowledged in the text.

Shivam Singh Teotia

20th June 2022

CERTIFICATE

This is to certify that Shivam Singh Teotia in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur has successfully completed his internship at Seva at home India Pvt. Ltd. during 22nd March 2022, to 19th June 2022.

Place: Gurugram

Mr. Arun Datta

Date: 20th June 2022

Seva at Home

CERTIFICATE

This is to certify that dissertation using machine learning, identify potential societies for marketing the proactive healthcare product is a record of the research work undertaken by Shivam Singh Teotia in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and his approach to the research study has been sincere, scientific, and analytical.

Faculty Guide

IIHMR University, Jaipur

Date: 20th June 2022

School Dean

IIHMR University, Jaipur

Date: 20th June 2022

ABSTRACT

Title- Using machine learning, identify potential societies for marketing the proactive healthcare product.

Background of the study: Marketers will not be able to compete in the digital age unless they master data, analytics, and automation. In the digital marketing industry, machine learning is being used to increase customer engagement through personalization and customization of marketing journeys. For marketers, machine learning has been a valuable tool in capturing campaign data and transforming it into experiences that maximize customer happiness and company profits. By using the machine learning we are going one step ahead in finding out the potential marketplace and then promote the proactive healthcare product, which usually focus on teleconsultation, telemedicine, home health checkups, nursing at home.

Objectives:

- Gather data of societies such as the number of units, rental cost, property cost, and type of amenities.
- With the help of machine learning algorithms (Unsupervised learning) to make the cluster of societies on the basis of collected information and clusters them on strata basis.
- Find out the potential societies in which we can promote our Seva Prime.
- Organise the health camps in selected societies
- Address as many health-related issues as possible while keeping the services affordable.
- Gather and analyze data from residents' feedback in societies.

Methodology- Primary data was collected from various housing websites, and a machine learning model was built to create clusters of different strata societies based on this data. Based on the model's findings, health camps were organized in the selected societies, and feedback was gathered via a questionnaire.

Results- According to our observations and data, the majority of residents of the societies where we organized the health camp are likely to use our services, implying that our machine learning model correctly predicted the societies. The response we received from these societies was overwhelmingly positive. In these societies, we successfully organized a health camp, and good number of residents became customers of our health package product.

Conclusion

By using the machine learning algorithm, we had successfully segmented our target societies, then we organized health camps in the targeted societies and were also successfully convinced the residents of these societies to buy our proactive healthcare product.

Keywords- Machine Learning, Marketing, Unsupervised learning algorithms, Healthcare, Preventive healthcare

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On the very beginning of this report, I would like to extend my sincere gratefulness and heartfelt appreciativeness towards all the respected personages who have helped me to attempt this endeavor. Without their active guidance, assistance, cooperation, and motivation, I would not have made advancement in the report. It is a privilege to have a wonderful 90 days (22nd March – 19th June) internship in India's leading home healthcare organization. The internship experience I had with the **SEVA AT HOME, GURUGRAM** was a great chance for growth, learning and professional evolution. I am appreciative for this chance and for getting an opportunity to meet such countless brilliant individuals and experts who directed me through this internship.

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I would like to express genuine thanks to **Dr. P.R. Sodani** (President, IIHMR university, Jaipur) for giving me a chance to do summer internship. Now, I would like to express my honest gratitude towards my mentor at IIHMR University, **Mrs. Varsha Tanu** (Associate Professor) for her support, invaluable instructions, and supervision. This report is the result of his meticulous and generous outlook.

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I comprehend this possibility as a big milestone in my career progression. I will always attempt to use learned skills and knowledge in the best potential way, and will strive to work on the developments, to attain desired career aspirations.

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ABBREVIATIONS

WHO- World Health Organization

ML- Machine Learning

AI- Artificial intelligence

CHAPTER 1: INTRODUCTION

Healthcare research is beneficial to society because it can result in critical innovations such as new treatments, tests, vaccines, prevention policies, and other widespread advancements that affect healthcare and its delivery to the general population. The incorporation of information technology into the health sciences was a significant advancement in this field because it made clinically rich information available in a structured format, allowing for the advancement of information-centered research in this area. This type of research is more efficient and less expensive, allowing for large amounts of data to be analyzed to identify unexpected circumstances, paradigms in subcategories of subjects that would not naturally be included in controlled experiments, and work with complex diseases about which little is known. Modern healthcare is seeing an increase in the quantity, variety, and accessibility of health information, which suggests that more compelling statistical techniques are acceptable to use the best of this health data. Machine learning is a unique example of such robust procedures.

1.1 Machine Learning

Artificial intelligence is a broad discipline concerned with the comprehension and development of computer programmers that exhibit key aspects of intelligence. One of the critical aspects discovered in its subfield known as machine learning is the ability to comprehend. Machine learning was coined in the 1950s by Arthur Samuel as "a field of study that provides computers with the ability to learn without being explicitly programmed." Decades later, in 1997, the International Business Machines Corporation's (IBM) Deep Blue machine learning curriculum defeated chess legend Garry Kasparov, a historic event for machine learning. This exemplifies the exceptional ability and progression of machine learning algorithms, which instigated a paradigm shift in the Computer Science span, which primarily focused on "manually programming computers," into evolving an entire novel field with the focus on "getting computers to programmed on their own" (based on previous involvements and basic preliminary situations.

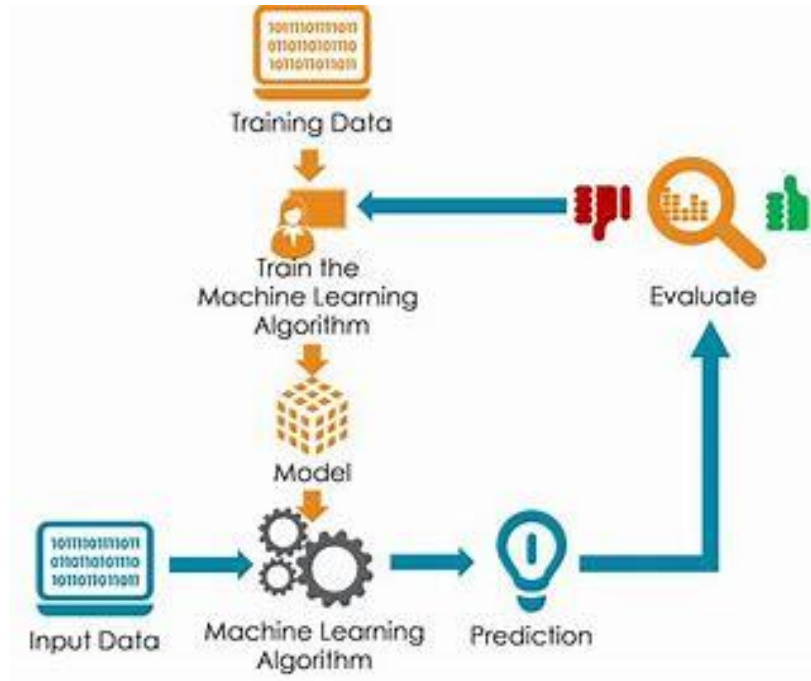


Fig 1. Process of machine learning models

While discussing machine learning algorithms, it is critical to consider why machines should learn rather than simply creating them to function as expected. The reasons for this have a lot to do with the limited human capacity to deal with massive amounts of data, multiple variables at once, and ever-changing environments, all of which would make manual coding impractical (if not impossible) in the following tasks:

- Responsibilities that are too complex to properly delineate, except in the case of examples in a sequence of inputs and outputs
- Responsibilities that include on-the-job improvement, as all environmental attributes are unknown.
- Responsibilities with a large volume of existing intelligence that makes explicit coding impractical.
- Responsibilities with changing environments that necessitate constant reform.

A machine learning technique, in general, works by learning how to accomplish a task from a set of instances or interpretations, and then improving its execution while performing the specified

task! To say that learning occurred implies that the structure in question changed its composition, programming, or data in order to improve the execution of the designated task, based on illustrations or observations.

The knowledge gained on how to perform the task in question is summarized in the form of a prototype, so that when given a completely new set of statistics, this model can complete the task within an acceptable execution level, assuming that the teaching data is representative of the most recent data.

Here are several machine learning approaches that are used in various types of problems. The most common are regulated, unsupervised, and reinforcement learning. Nonetheless, the articles that make up this dissertation are only regulated approaches are permitted. The left ones are beyond the scope of this introductory description. The illustrations or statements used to instruct the models in regulated learning have known labels that correspond to accurate outputs, and the algorithm will present in a directive way to map the inputs to the outputs. Among the most common problems encountered in this knowledge approach are categorization, in which the output is exemplified by a limited number of categories, and regression, in which the productivity is a real-value number.

Several machine learning concerns are well-constrained, with no significant disagreements in demonstrating the inputs into relevant variables to be used in model construction.

However, complex real-world issues frequently include information related to spontaneous signals, spontaneous sounds, dialect, spontaneous images, or visual events, which are difficult to convert into explanatory measures. To address this challenge, a new type of machine learning algorithm was developed: profound learning. Profound learning can be used with a variety of learning approaches and differs significantly from the various traditional machine learning modalities. Whereas the latter requires the expertise of specialists to hand-craft elements, deep learning offers automated characteristic engineering, implying that it instinctively finds the essential illuminating elements in the data first, and then performs the specified task (e.g., categorization, regression). Both deep learning and additional traditional forms of machine learning work to develop models for the purpose of making precise predictions!) Another interest that may arise when developing a model is deciphering it to understand why the model functions and how the elements are combined to assess the marked result. Understanding the modelling

significance is critical because there is a significant tradeoff to be considered, as in almost all cases, the more intricate the algorithms become, the less understandable they become.

In a nutshell, machine learning is not a new concept; it has been evolving for decades, responding to much more complex and difficult tasks. This proposes the ability to solve problems that are either infeasible or impractical to solve using physical coding, and it notes the presence in modern life, from weather reports to claims that have the potential to significantly affect people's lives, as in the case of healthcare.

1.2 Machine Learning to segment the customer's type

An algorithm examines hundreds of data points about each customer using machine learning. It looks for patterns in what they do and buy as individuals. The algorithm then identifies potentially important "features" about each customer based on all those individual data points (for example, "clicked on an email on a Wednesday"). Finally, using a clustering algorithm, you can use those features to automatically group customers into segments.

As a result, you will have a truly data-driven understanding of your various customer types. Then, based on your best clusters, you can label your actual customers, shape content and strategy for the most important clusters, and create digital lookalike audiences on advertising platforms.

1.3 Machine Learning in healthcare

The health sector is expanding faster than the economy overall. Between 2000 and 2017, global health expenditure in real terms increased by 3.9 percent per year, while the global economy expanded by 3.0 percent per year. The global healthcare expenditure in 2017 was expected to reach US\$78 trillion, equivalent to nearly 10% of global GDP in that year!" The increase in health expenditure in the United States up to 2017 was primarily due to rising healthcare service prices and associated intensity. This increase can be attributed to a number of factors, including an ageing and growing population, disease incidence and prevalence rates, and an increase in pharmaceutical costs. The rising cost of care raised concerns about the efficacy and efficiency of healthcare systems, and it was one of the primary motivators for changing this segment, which had previously been primarily focused on hospital care, to prioritize preventative activities and outpatient services.

Several tasks must be completed before healthcare systems can be formed. A patient is first screened and diagnosed, which includes categorizing the patient's records based on information transmitted by assessments, probes, and previous medical records. Following that, there are various treatments and follow-ups, which include adequate effective planning and management of detailed events because of the presented information for future patient referrals. However, interoperability is a persistent issue in health information; the lack of a universal data scheme for health care organizations should make combining data across a health structure difficult. Existing approaches in healthcare do not meet the current data integration requirements and should be reconsidered the extraneous information needs of machine learning.

1.4 Proactive Healthcare

Proactive care refers to the ongoing patient-provider conversation and active monitoring of conditions to help prevent life-threatening emergencies. When care teams communicate regularly with at-risk patients (as well as each other) about conditions, diagnostics, and treatment protocols, they are practicing proactive care.

Proactive care is individualized healthcare that encourages patients to take greater control of their own care and sensitive data by making problem prevention second nature to care teams. Patients who aren't sick may forget to check their vital signs, take their medications or supplements, exercise, eat nutrient-rich foods, and make follow-up appointments. When clinicians on their care team check in on them on a regular basis, patients are more likely to perceive them as trustworthy partners and respond to friendly reminders or informative alerts. These bonds can last a lifetime.

When implemented correctly, proactive care can enable whole-person care by tracking lifestyle changes, encouraging self-monitoring and sensitive data sharing, and scheduling outpatient visits and follow-up lab tests. This mutual trust leads to more fruitful outpatient visits and wellness checks. It allows care teams to detect red flags and intervene in order to avoid critical issues. This personalized healthcare encourages patient retention over time.

1.5 Seva Prime-Proactive Healthcare product



Introducing
SEVA PRIME

**SMALL SUBSCRIPTION.
BIG BENEFITS.**

**MONTHLY, QUARTERLY,
ANNUAL PLANS**

**HEALTHCARE SPECIALLY
PERSONALISED FOR YOU**

- 24X7 DOCTOR
TELECONSULTATIONS**
Unlimited teleconsultations
in 7 languages*.
- SPECIALISTS
TELECONSULTATIONS**
Follow-ups with a
panel of specialists
(cardiology, diabetes, etc).
- NUTRITIONIST
TELECONSULTATIONS**
Personalised diet plans & advice
by appointment.
- COVER UPTO 6
FAMILY MEMBERS**
One subscription for
upto 6 family members.

**INDIA'S MOST COMPREHENSIVE
HEALTHCARE AT HOME PLAN**

- ✓ 24X7 Doctor
Teleconsultations
- ✓ Specialists
Teleconsultations
- ✓ Nutritionists
Teleconsultations
- ✓ Psychologists
Teleconsultations
- ✓ Dedicated Case Manager
- ✓ Health Assessments
- ✓ Caretakers, Nurse
at Home**
- ✓ Comprehensive
Family Coverage
- ✓ Virtual Caretaker
Screening
- ✓ Ambulance
Services**
- ✓ Health Records
- ✓ Health Information

1800-120-800003 (IN)

*INCLUDES ENGLISH, HINDI, MARATHI,
TELUGU, GUJARATI, TAMIL AND KANNADA
**PAY AS YOU GO SERVICES

**BROUGHT TO YOU BY SEVA AT HOME,
INDIA'S LEADING TECH-ENABLED
HEALTHCARE-AT-HOME PROVIDER.**

Fig 2. Seva prime Flyer front page

ITEM	SEVA PRIME MONTHLY	SEVA PRIME QUARTERLY	SEVA PRIME ANNUAL
UNLIMITED 24X7 DOCTOR TELECONSULTS	☒	☒	☒
TELECONSULTS WITH EMPANELLED SPECIALISTS	2	6	20
TELECONSULTS WITH NUTRITIONISTS	3	9	30
TELECONSULTS WITH PSYCHOLOGISTS	3	9	30
HEALTH RECORDS	☒	☒	☒
EVENT INVITES FOR HEALTH INFORMATION	☒	☒	☒
DEDICATED HEALTH & WELLNESS ADVISOR	☒	☒	☒
UPTO 6 FAMILY MEMBERS COVERED	☒	☒	☒
SPECIAL OFFERS EXCLUSIVELY FOR YOUR SOCIETY			
DISCOUNTS AT SELECT DIAGNOSTIC CENTRES	UPTO 20%	UPTO 20%	UPTO 20%
DISCOUNTS AT SELECT HOSPITALS ON OPD/IPD	5-10%	5-10%	5-10%
COMPLIMENTARY MEDICINE VOUCHERS	WORTH INR 500	WORTH INR 1,000	WORTH INR 3,000
COMPLIMENTARY AT HOME HEALTH CHECKUP FOR 2 MEMBERS	☐	☐	☒
NURSING CARE AT HOME POST HOSPITALISATION FOR 10 DAYS (WORTH INR 20,000)	☐	☐	☒
CARE ATTENDANT AT HOME FOR 10 DAYS (WORTH INR 10,000)	☐	☐	☒
HOME HEALTH KIT (BP MONITORING MACHINE, GLUCOMETER, PULSE OXIMETER)	☐	☐	☒
PRICE (LIMITED TIME DEAL)	INR 1299	INR 2599	INR 6599

Fig 3. Seva Prime Flyer back page

1.6 Seva Prime - Small Subscription, Big Benefits

Seva prime is a health and wellness subscription package that includes a dedicated medical advisory team with unlimited consultations and 24/7 access to teleconsultation doctors in seven (7) different languages, making it a holistic healthcare solution for families.

Seva Prime is subscribed in either of the following ways:

Based on subscription package-

- Monthly
- Quarterly
- Annually

Based on Subscription type-

- Self & Family
- Sponsored - For domestic help or families in the need of financial assistance
- Corporates - For employees
- Management committee – For residential society members

1.7 Objectives of seva prime

1. Help individuals to improve daily life activities and live with greater independence
2. Promote the individual optimal level of well-being
3. Helps the patient to stay at home and prevent excessive hospitalization costs.
4. Provide vital health services and to implement novel care practices.
5. Provide high-quality, comprehensive healthcare in the comfort of our clients' homes.
6. Assist the family to maintain an active and healthy lifestyle.
7. Provide qualified, skilled services at home with a focus on prevention, rehabilitation, and therapeutic care.
8. Each client's individualized home health care plan is tailored to meet their specific physiological, safety, self-esteem, and self-actualization needs.

1.8 Our customers

1. Individuals/Families
 - Health conscious/Healthy families
 - Post-surgery patients who require medical attention
 - Elderly patients
 - Patients with acute and chronic medical conditions
2. Corporate Employees
3. Resident Welfare Associations' Families

1.9 Scope of services

- 24*7 doctor teleconsultations
- 20 Specialists' doctors' teleconsultations
- 30 Nutritionists' teleconsultations
- 30 Psychologists' teleconsultations
- Covers upto 6 family members
- Dedicated Health & Wellness Advisor
- Comprehensive family coverage
- Regular Health assessments
- Health information & event invites
- Virtual caretaker screening
- Health records
- Emergency preparedness plans for each family member
- Health monitoring kits and wearables*
- Home Security*
- Will preparation*
- Ambulance services*
- Discounted home healthcare services - Caretaker, nurse, physiotherapist at home*
- Discounts at provider networks (doctors & hospitals) *
- Discounted Health Checkups*

*Pay as you go services

1.10 Special Benefits for Your Employees

- 10 days nursing care at home
- 10 days attendant care at home
- Medicines voucher worth INR 2,000
- Health devices worth INR 4,500

- Health Checkups worth INR 7,500
- 20% discount on diagnostic tests
- Discounts on OPD/IPD

1.11 Implementation of process flow

Seva Prime subscriber

Table 1. Seva Prime process flow

Task	Timeline
Individual/ Corporate/ RWA families buys Seva Prime subscription from the website and becomes a Seva Prime member	Day 1
In case of corporate, MOU is signed between SAH and the client (based on mutually agreed- terms and conditions)	
Individuals' details (Name, Contact No., E-mail id, Address) gets updated on the platform and the individual gets registered on the seva platform.	
In case of bulk registration of corporates, employee's data (Name, contact no., E-mail id, address) is provided by the client's HR and the registration is done by tech team of SAH on the platform	
Welcome email An automated email is sent by SAH along with a welcome message mentioning details of Seva Prime Membership number and the customer care number to the subscriber	Immediately
HWA is allocated to the family and subscriber will reflect under HWA allocation list in our platform	Within 24 hours
The contact details (mail id and contact no.) of the subscriber will be available to HWA for further communication	

A mail and WhatsApp message is sent to subscriber by the HWA with attached link to add family member details Link: https://seva.force.com/commerce/s/add-a-family-member	Within 1-2 days
Once the patient has added their family members in the link, it would be visible under the allocated HWA's members list on the seva.force portal	
HWA will send a follow up mail (if the subscriber doesn't respond to the first mail)	After 2-3 working days
A WhatsApp message will be send asking them for their available time to connect	
HWA will introduce themselves and inform the customer about all the health benefits they will get from the subscription over a call	As per the convenience of family
Have an initial assessment – Ask about their family members (contact number) and their relationship?	
Ask if there is any active patient (if yes, ask about their details: demography, medications, history, etc.) Maximum call duration-10-15 minutes	
Schedule a clinical assessment if they require (Nutritionist, Physician, Nurse, Psychologist) according to the availability of everyone. Assessment should capture family members health status and their needs.	As per the availability
Arrange the meeting over a WhatsApp video call. The meeting should be scheduled for each family member either collectively or individually based on their convenience	
HWA should assess the needs of individual family members and proactively set up appointments with relevant service provider	

Periodic communication to all Seva prime members will be done through newsletter (Seva Prime digest) regarding: • New services • Seva Clinics • Webinars • Patient testimonials • Seva heroes • Health & Wellness tips	
An emergency plan for each separate family member will be prepared and shared with the concerned person (explaining each step) and assure them that we are there with them at every point	Within 1 week
Periodic WhatsApp message/ call will be made to ensure that the family is doing well	Every 10-15 days

1.12 Home care Patients (process flow)

Table 2. Process of home care patients

Activity	Timeline
Seva Prime trial One month Seva Prime trial subscription is provided to home care patients, and they become seva prime member for a month	Day 1
An HWA is assigned to the family and is introduced to the family during IDTA call.	As per the convenience of family and medical team
HWA contacts the family and inform them about the ongoing seva prime trial subscription and its benefits.	Within 2-3 days of IDTA call

In case family needs any kind of medical assistance, HWA schedules call with the concerned medical team.	
The family reaches out to the HWA in case of any need.	As per the need
The HWA will take a follow up every 15 days.	Every 15 days
Ask feedback about the services of seva prime and ask if they are willing to pay for the services	After the subscription ends

1.13 Rationale: We currently have data on our customers' preferences and their preferences for amenities, but we have not used this data effectively or didn't leverage this data to promote our products in a right segment of customer. But with the help of machine learning, you will have a true data-driven understanding of your various customer types. You can then label your actual customers, shape content and strategy for the most important clusters, and create digital lookalike audiences on advertising platforms using your best clusters.

1.14 Objectives

- Collect the data of societies like number of units, rental cost, property cost, type of amenities
- With the help of machine learning algorithms (Unsupervised learning) to make the cluster of societies on the basis of collected information and clusters them on strata basis.
- Find out the potential societies in which we can promote our Seva Prime.
- Organised the camps in the selected societies.
- Address the health-related issues as many as we can and at the same time making the services pocket friendly.
- Collect the data on feedback of societies' residents and make the analysis.

CHAPTER 2: REVIEW OF LITERATURE

S.No	Source	Author	Title	Study Design	Findings
1.	ScienceDirect	Liye Ma, Baohong Sun	Machine learning and AI in marketing – Connecting computing power to human insights	Experimental Research	Machine learning methods and using them as core components in marketing research, need to deal with unstructured data,
2.	Dataaspirants	Saumya Awasthi	Five Most popular unsupervised learning algorithms	Observational Research	For the unlabeled data, we mostly used unsupervised learning algorithms, and there are around 5 most commonly used unsupervised algorithms
3.	Towards Data Science	Imad Dabbura	K-means clustering: Algorithm, Application, Evaluation Methods, and Drawbacks	Experimental Study	The Kmeans algorithm is an iterative algorithm that attempts to divide the dataset into K distinct non- overlapping subgroups (clusters), with

					each data point belonging to only one of these groups. It makes an effort to keep intra-cluster data points as similar as possible while keeping clusters as dissimilar (far) as possible.
4.	Retina	Brad Ito	4 top machine learning use-cases for consumer marketing	Observational study	Machine learning can be used in 4 ways to market the product in the market. • Data driven customer segments • Customer Journey optimization • Customer lifetime value modeling • Digital marketing optimization
5.	NCBI	Scott a waldman	Healthcare Evolves from	Observation research	The evolution of healthcare is driven

			Reactive to Proactive		by the decoding of health and disease pathways. Historically, therapeutic paradigms have relied on interventions that alleviate the symptoms of pre-existing diseases.
6.	Science.org	M.I Jordan and T.M. Mitchell	Machine learning: Trends, perspectives and prospects	Observational research	Machine learning is concerned with the problem of creating computers that can learn on their own. It is one of today's fastest growing technical fields, straddling computer science and statistics, as well as artificial intelligence and data science.
7.	AIsel.net	Keng L. Siau and Yin Yang	Impact of AI, robotics and machine learning on sales and marketing	Observational study	The impact of AI, robotics, and machine learning on sales and marketing is unprecedented. A

					perfect storm is brewing! On the one hand, online retailers such as Amazon are destroying physical stores. The future of brick-and-mortar sales and marketing is bleak.
8.	Arxiv.org	Irene y. Chen, Emma Pierson	Ethical machine learning in Healthcare	Observation study	The application of machine learning (ML) in health care raises several ethical concerns, particularly because models have the potential to amplify existing health inequities. Equitable ML in the advancement of health care. The ethics of machine learning in health care are specifically framed through the lens of social justice.

CHAPTER 3: Methodology

3.1 Data Collection

To build a machine learning model, we need many data sets, which we obtained from various sources. Our goal was to collect data from societies recommended by our third-party vendor. Our vendor only provides us with three data attributes: the name of the society, the city of the society, and the number of units in that society.

Now that we have this data from our third-party vendor, it is time to add some more meaningful attributes to it, such as BHK configuration, rent charges, maintenance charges, property value per sqft, population living in that society, and amenities present in that society. We had collected data on approximately 1500 societies on the same attributes.

3.2 Data Preprocessing

This is the second step in any ML algorithm; after gathering the data, it is time to preprocess it. This step entails cleaning the data, performing feature engineering on the data set, and dividing the data into training and testing data sets. The ratio of dividing the data set into training and testing is typically 8:2. However, because we used unsupervised machine learning algorithms, we did not need to divide the data set; we only needed to clean it and do some feature engineering on it.

3.3 3 Unsupervised Machine Learning Algorithms

Following are the clustering types of Machine Learning:

- Hierarchical clustering
- K-means clustering
- K-NN (k nearest neighbors)

3.3 Hierarchical clustering

Hierarchical clustering is a clustering algorithm that creates a hierarchy of clusters. It starts with all of the data, which is assigned to their own cluster. Two close clusters will be in the same cluster in this case. When there is only one cluster left, the algorithm terminates.

3.4 K-means clustering

K denotes an iterative clustering algorithm that assists you in determining the highest value for each iteration. At first, the desired number of clusters is chosen. This clustering method requires you to divide the data points into k groups. A higher k indicates smaller groups with greater granularity. Lower k values indicate larger groups with less granularity.

The algorithm produces a set of "labels." It allocates each data point to one of the k groups. Each group in k-means clustering is defined by defining a centroid for each group. The centroids act as the cluster's heart, capturing and incorporating the points closest to them.

3.5 K-NN

The K-nearest neighbor classifier is the most basic of all machine learning classifiers. It is distinct from other machine learning techniques in that it does not generate a model. It is a straightforward algorithm that stores all available cases and classifies new instances using a similarity metric.

When there is a large gap between examples, it works very well. When the training set is large and the distance calculation is complex, the learning rate is slow.

3.6 Model Selection

For our model we had selected k-means unsupervised learning algorithm, because algorithm produces a set of "labels." It allocates each data point to one of the k groups. Each group in k-means clustering is defined by defining a centroid for each group. The centroids act as the cluster's heart, capturing and incorporating the points closest to them.

CHAPTER 4: RESULTS

4.1 Result of machine learning algorithms

Our model created three different clusters, and all of them represent different strata of societies.

Cluster 0: Represent societies which consist middle class families.

Cluster 1: Represent societies, which consist upper middle-class families.

Cluster 2: Represent societies, which come under high class families.

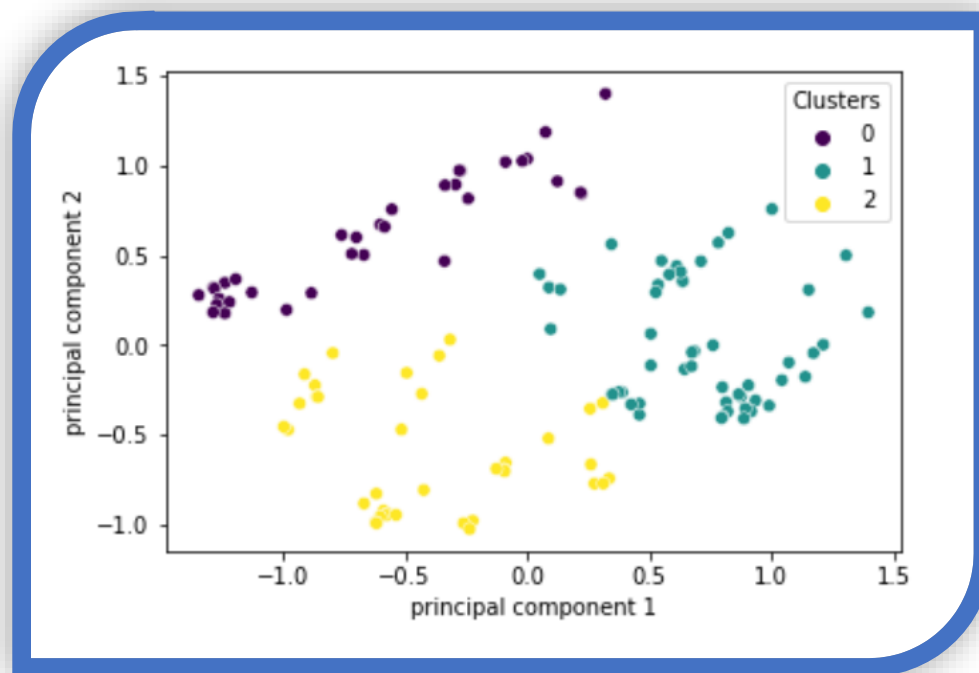


Fig 4. Clusters of societies

We targeted cluster 1 societies for our seva prime product because cluster 1 societies have families from the upper middle class, and the earners in these families mostly work in the corporate sector or run a family business, and these families are more active in taking preventive measures for their health.

4.2 Result of Healthcare camps in societies

We organized healthcare camps in various cities based on the recommendations of our machine learning algorithm prediction, and these camps were a huge success. In the healthcare camps, we checked the basic vitals of the society's residents and used our CRM teams to market our seva prime product in the community.

Table 3. Societies Data

Sno	Society Name	Location	Date	Total Participant	Seva Prime Sold
1	Bharat City	Ghaziabad	14-May-2022	100	8
2	Omaxe Nile	Gurgaon	15-May-2022	150	15
3	SMR	Hyderabad	14-may-2022	120	10
4	ACC	Hyderabad	15-may-2022	130	12
5	Hinjawadi Hills Society	Pune	14-May-2022	140	11
6	Brahma Suncity Platinum	Pune	15-May-2022	135	9
7	Millenium Towers	Mumbai	14-May-2022	170	12
8	Oberoi Woods	Mumbai	15-may-2022	180	15
9	Alembic Urban Forest	Bengaluru	14-May-2022	165	12
10	Purva Venezia	Bengaluru	15-May-2022	150	10

11	Times Residency	Gurgaon	4-June-2022	200	18
12	BPTP Freedom Park	Gurgaon	5-June-2022	220	22

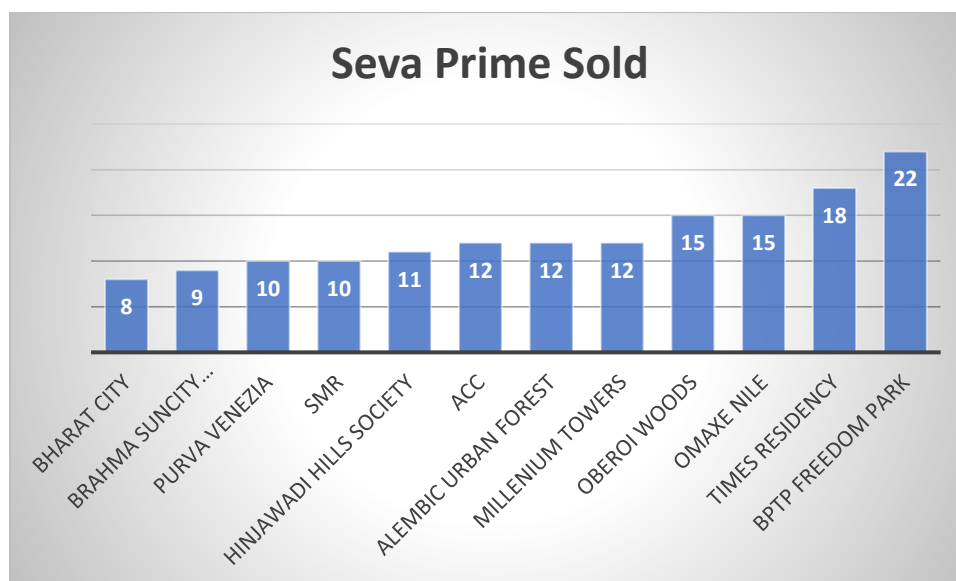


Fig 5. Number of seva prime sold in societies

As shown in the table and graph above, we were able to sell a significant number of seva prime subscriptions to residents of various societies. We sold a good number of seva prime and had a good number of participants in the first phase of camps, which was held between the 14th and 15th of May 2022. In the second phase, we go full force, putting posters in the societies one week in advance, and putting a canopy outside the clubhouse, not inside, to get the full views of the society residents. This time, the number of participants increased, and they expressed greater interest in our product after receiving favorable consultations from our doctor and nutritionists.

Table 4. Our Healthcare camp's picture





Chapter 5: Conclusion

The dissertation took an experimental study approach, with the goal of investigating machine learning's application in the healthcare domain through its deployment in the field of marketing a proactive product. The application of machine learning considers it as a modern healthcare technique that can be used to solve peculiar, applied issues.

Finding useful training data for machine learning was a difficult task, but once you have the right data with useful features, the process will be much easier. We get better results by dividing the society data into different clusters and approaching the societies based on these clusters, for example, cluster 1 belongs to societies with good amenities and low property prices.

We organized health camps in various cities with similar societies, and we received a very positive response from these societies. We also collected some testimonials from residents about our health camp and product, and we are overwhelmed by them. In the first phase of the campaign, we sold our product in these societies, and the conversion rate was around 8%. After placing prior banners in the society and forwarding WhatsApp messages in the societies, we received a large number of participants in the second phase, and the conversion rate increased to 12%.

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