



5. Different AI systems for customer service

After learning about the data ecosystem and sources to obtain data, let's move forward to learning about the major AI systems that are currently in use.. thinking about what are the major AI systems currently in use.

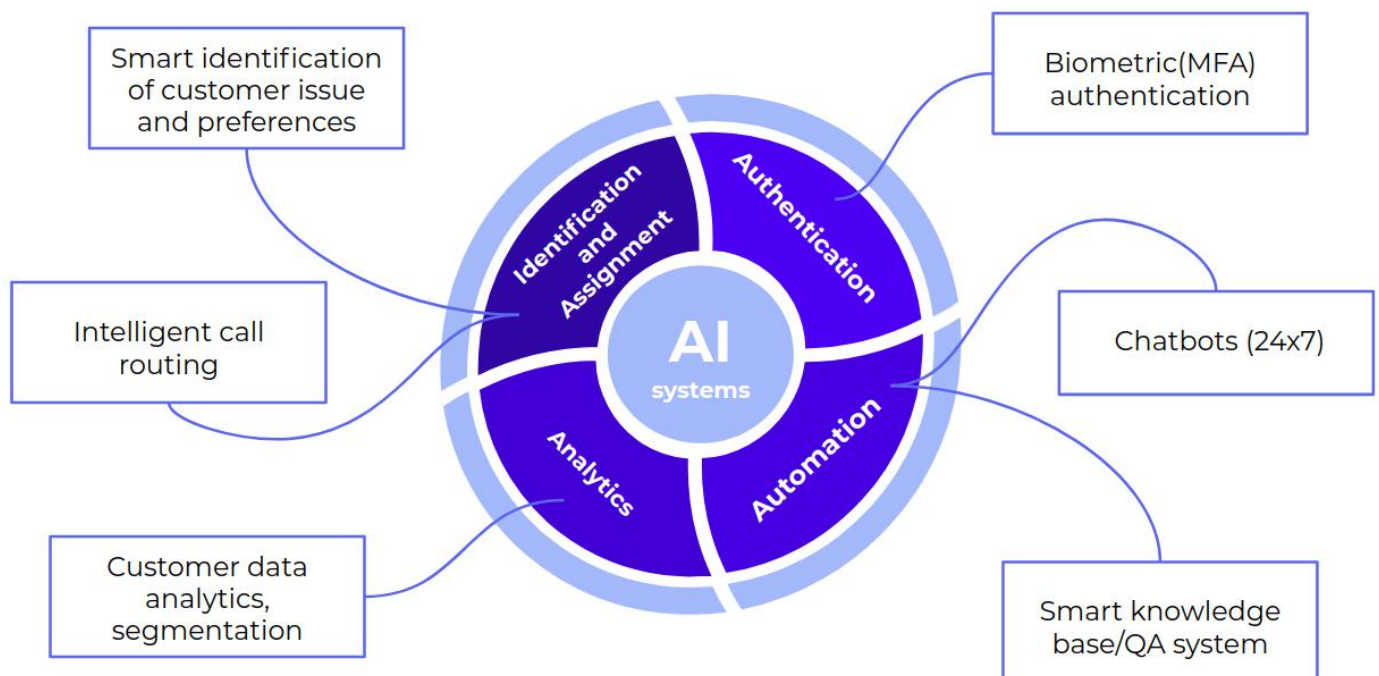


Figure : Uses cases of AI in various areas of customer service

We have divided the use cases of AI systems in customer services into four major categories as shown in the above figure, that are:

- **Identification and assignment** - These systems help in customer intent identification and consequent optimal call routing.
- **Authentication** - Systems that automatically identify users either using biometrics or phone numbers fall under this section.
- **Automation** - AI systems that automate the customer service department's task for decreased handle times/interactions fall under this category, such as chatbots and AI assistants.
- **Analytics** - All the techniques and tools for customer data analytics falls within this sector, such as sentiment analysis, customer segmentation and even recommendation systems.

Let's discuss all of them one by one.

Customer intent identification system

Customer intent identification system refers to AI systems that identifies the customer's key issues, needs and their sentiments, when they contact the customer service department for queries. This system aids in reduction of handle time by providing agents better customer need identification, and help in AI-enabled assignment systems, that are discussed in the next section.

Regarding the data to be used, the major source of data for this system is user-generated contents(UGC), **social media, customer issue tickets, and voice call-ins.**

- **Social listening**, a process of monitoring and tracking social media channels for mentions of your brand, product, service and even your competitors, is a useful tool for extraction of customer data.

- Here, is a video by [Godaddy guides](#) on five ways to provide customer service with social listening.
- Learn about the advantages of social listening by reading [survey](#) by clutch, and for knowing about most popular social listening tools, visit this post by [hubspot](#).

- **Ticketing systems** are customer service tools designed to manage and support customer issue cases. Few examples are hubspot, jira service desk, etc.

For more knowledge regarding the **ticketing system**, go through this [web post](#) by the balance small business.

The key steps for identifying intents of customer services using AI systems are demonstrated below.

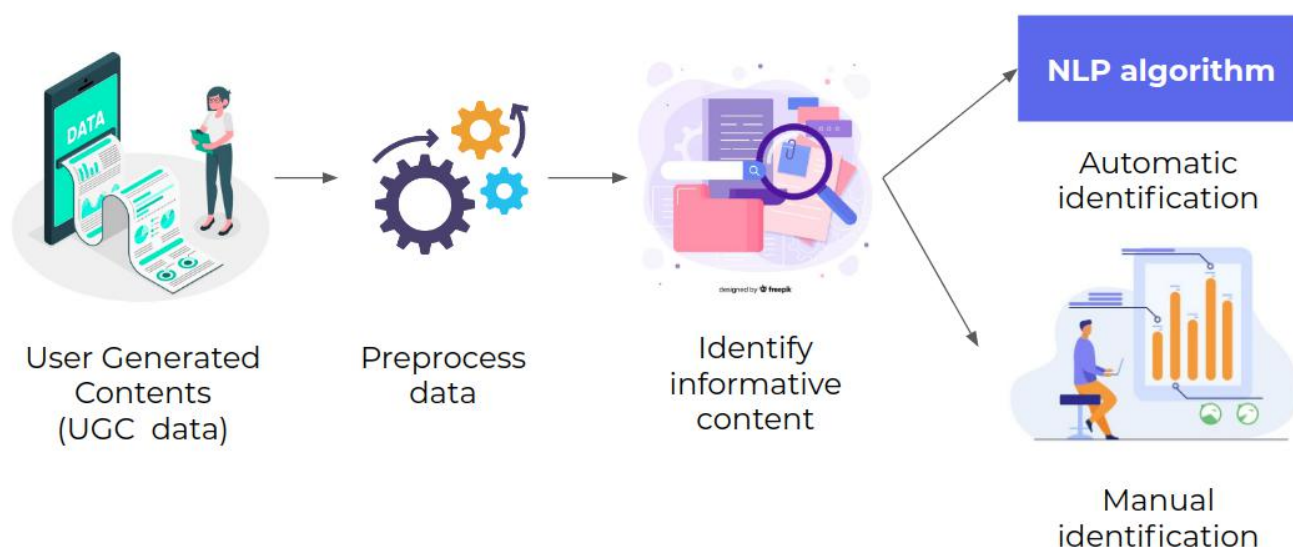


Figure : Steps for development of intent identification system using UGC

There are four steps in developing an intent identification system.

1. Generating training(UGC) data

As with any AI system, the first step is generating training data using the previously mentioned social listening tools, ticketing systems, and stored call-in records. In this step, you as a manager must identify all the sources, collect those data and combine them into a single unit and also label them as per your need. For example: If you want to identify the customer's emotion, you might want to label the data as angry, sad, happy and so on.

2. Preprocessing the data

Next is the preprocessing step, where the raw data are preprocessed into proper usable format for the ML systems to be used. Examples can be audio to text conversions, removal of punctuation and stop words, etc. Here is an article by Kdnuggets on "[A General Approach to Preprocessing Text Data](#)". Do visit for further investigation on preprocessing methods for text data.

Resource Tip: Want to learn about speech to text models for conversion of audio to text? Visit this [article](#) on AnalyticsVidhya for learning to develop speech to audio models using python.

3. Identification of information content

Next, depending on the corpus, UGC can contain only a minimal amount of content that represents the customer's intent. For example non-informative content might include evaluation sentences such as:

- "This product can be found in Walmart",

While informative content might include:

- "This product has poor build quality and is difficult to clean and use."

In this step, ML can be applied for identification of informative content from the word embeddings and remove uninformative ones. A research by [Timoshenko, Artem and John R. Hauser](#) trained the word embedding from the previous step into a Convolutional Neural Network(CNN) model for filtering out non-informative sentences from the rest of the corpus, reducing the amount of training data and time for building your AI system.

P.S.t AI systems are heavily affected by the data that is fed into the system. **Always try to clear out most of the uninformative data before training the AI system.**

4. Identification of intent

a. Automatic identification using NLP systems

After the content filtering, you can either use State of the Art(SOTA) NLP methods for automatic identification of intents.

Try this [online sentiment analysis demo](#) by Text2data. Type various texts and it will classify whether your text is positive or negative. For further information regarding customer sentiment analysis, visit this [guide](#) by MonkeyLearn.

b. Manual identification using expert analysts

Or you can use professional trained analytics to manually identify the customer intent.

An additional step for improving performance of intent identification systems are clustering repetitive and most occurring words and needs, and then feeding the clustered words into NLP systems. This results in less training time and better performance.

You might require knowledge of sentence clustering before applying this in your model. For that, go through this [tutorial](#) by eduonix.

Intelligent call routing

Since AI systems aren't completely capable of dealing with identified customers due to their complex needs and queries, your customer service department might require intelligent call routing systems.

Intelligent call routing, ICR for short is an AI enabled system, which during the interaction between user and agent, first identifies the caller and the reason, intent for the call, then assigns the customer to the right customer service agent. These systems are designed to increase efficiency of automated call management and improve the customer experience for callers. ICR systems reduces call duration by matching agents with appropriate customer queries. These lead to reduced customer service agent costs and increased customer satisfaction.

According to McKinsey and Company's article "[Winning the expectations game in customer care](#)", **94% of customer care** agents think they require new agent hire or train current ones with new skills. If customers are unable to contact the optimal agent, if there is a gap between customer and agent, then all of the investment on service agent training will go to waste. This is where ICR systems come to the rescue, by connecting users with optimal agents.

The working of ICR systems is shown in the figure below.

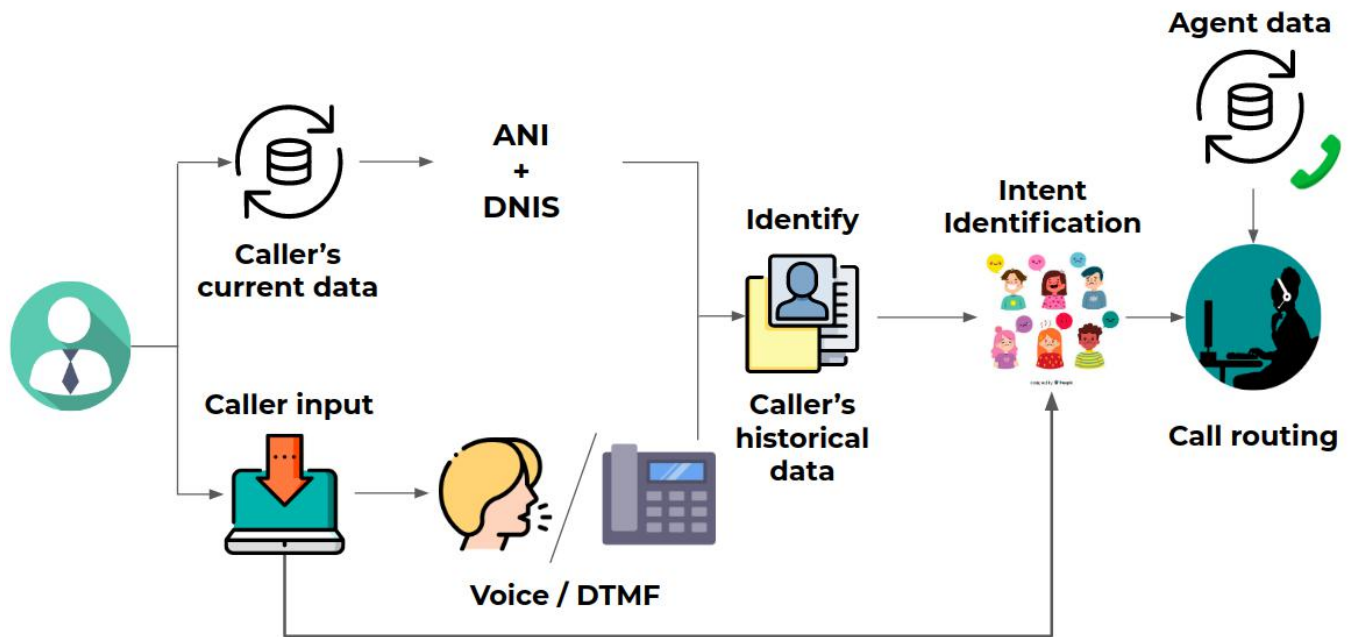


Figure : Procedure on how ICR systems work.

Starting with customer calling the service agent, the first thing ICR utilizes are the customer's data, which includes:

- **Caller's current data**

First, a combination of two data gathering features is used for identifying the caller.

- Automatic number identification(ANI)
- Dialed number identification service(DNIS)

- **Caller input**

Next is the caller's input that they give during the call with the agents. ICR takes help of Interactive Voice Response(IVR) systems, which allow customers to input their intent either using voice commands or Dual tone Multi frequency.

Combining both caller's current data and input, ICR system, it identifies the user using either DL systems such as biometric voice recognition or simple database matching.

- **Caller's historical data**

After identification of the caller, the ICR system uses the customer's historical data stored in the database, combining it with the caller's input for identification of caller's intent of call (using intent identification systems).

Additionally, after intent identification, ICR systems utilizes **Agent's data** such as agent's track record, training and skills, personality and his current task at hand. Combining the previously mentioned customer and agent data, ICR system finally matches data to criteria and rules the business which has set for sending calls to specific departments that have been deemed relevant for the caller.

If you don't want to build your own ICR systems, there are plenty available in the market. Visit this [article](#) by getvoip for more information on pros and cons of ICR systems with comparison of multiple ICR systems available in the market.

Key notes on development of ICR systems

- a. Maintain high quality of data, as should be with any AI system.
- b. Always search and control the integration issues of AI systems with pre existing ones.
- c. Measure impacts of the AI systems by monitoring KPI when the system is on and off.
- d. Don't forget to focus on other AI systems, identification and assignment is just the start.

Customer authentication system

Traditional authentication systems are time-consuming and frustrating to use. The reasons are simple and you as a user have experienced these issues yourself. Here, are few key findings from [Nuance internal customer research](#), 2016:

- Typing passwords takes a long time, and sometimes you might have to re-enter it again and again. **Around 49% of customers** said that traditional authentication is time-consuming and frustrating.
- Password reusability is an issue. Users find it difficult to remember passwords and then end up using the same or some variation of the same password for most of the authentication. **Around 67% of mobile** users reset password at least once a month.
- Password based authentication is less secure, they can be hacked easily. An account taken over by an incident of hacking on average cost consumers **five times** more than for any other type of fraud.

The ultimate solution to all of these limitations is a biometric authentication system. **Biometric authentication** systems are AI enabled systems for recognizing and verifying a person's identity through a unique **physical or behavioral trait** like the unique pattern of their fingerprint or eyes,

or the way they type or swipe their phone. Ways to identify the users can be from the iris of their eyes, face, voice and behaviors.

The benefits of AI assisted biometric verification are listed below:

- For customers
 - Less time consuming
 - No need to remember or reset passwords.
 - More secure, as biometrics aren't easily copied or decoded.
- For business
 - Better security lead to protect from frauds
 - Increased customer satisfaction
 - Operational saving by utilizing previously mentioned ICR systems.

Biometric authentication is subdivided into two types, active and passive methods of authentication:

- a. **Active method**, where customers are required to actively participate in verification by placing their face, finger in sensor or speaking to a microphone.
- b. **Passive method**, where no active participation is required, all the authentication is done behind the scene, say analyzing customer's voice during voice call-in.

These verification systems fall under the category of supervised learning methods. If you are interested in learning such recognition systems, visit this [link](#) and follow tutorial on face recognition using OpenCV library to develop your own face recognition system.

One tip while implementing such a biometric recognition system, always use a multi-modal approach, the advantage of multi-modal approach are:

- **Multiple choices between authentication mediums.** From a customer experience stand point, having voice authentication is great when calling from home or office but less optimal when they are calling from noisy streets. Same goes for fingerprint recognition that is great when you have a customer's captive attention, but dangerous if the user is driving from home.
- **Multi factor authentication is more secure.** For banking apps, fingerprint could be the easy access to get the pass to enter, but a transaction might require voice recognition for more robust and reliable authentication.

Regarding the improvement brought by biometric authentication, according to Nuance's "[Banking on biometrics](#)" report:

- [Tatra bank](#) has **cut the authentication times of customers by 66%** by integrating biometric authentication.
- [Barclays](#) upon integrating voice biometrics authentication has dropped its customer verification time **from 2 to 7 minutes to mere 20 seconds**.
- **72% of early Millennials feel more secure** about mobile fingerprint authentication than password systems.

Automated customer service system

Automated customer service systems are basically divided into two categories:

- **24x7 available assistants**, such as chatbots that are equipped with powerful NLP processing tools and are assigned to solve simple customer problems.
- **Behind the scenes assistants that** help customer service agents by providing valuable information about the customer, such as their intent, sentiment, and suggestion regarding the solutions and replies.

A chatbot is an AI system based on NLP architectures with 24x7 availability that simulates human conversation through a live chat interface. These systems analyze the user's text related to customer roadblocks and provide responses and solutions based on information it receives. Chatbots usually start their conversation with a greeting, and then process to gather user information and finally provide a solution. However, chatbots are AI systems that answer only simple user queries. For handling complex queries, they either:

- Reference search results from search engines.
- Redirect chat to customer service agents.

"[Getting started with AI using IBM Watson](#)" course, related to introduction of basics of Watson, question-answering computer system developed by IBM's DeepQA project, shows the statistics regarding the improvement of customer service in different businesses around the world. The course compares [AVA](#), a virtual assistant designed to resolve common support issues by Audodesk and human agents, saying:

- Human agents require investments of roughly \$15-\$200, while AVA takes only \$1.
- Average human agents handle a query at around 38 hours but AVA does it immediately.

Similarly, agent CORA of Royal bank of scotland caused improvement in customer services by around 60%.

Go talk with [Elbot the Chatbot](#), if you are bored from reading this chapter. Play with him for a bit and then return back to reading. You will be developing a chat bot using [RASA](#) in the tutorial of this chapter. If you are really interested and technically proficient, for a head start, you can go through the tutorial on developing [chatbot using RASA](#).

Moving on from chatbots, let's discuss advanced assistants that help customer service agents behind the scenes. Assisted customer service applications are systems that empowers agents, helping them behind the scenes, by providing recommendations on the replies to customers, showing relevant information regarding customer's query, even their issue priority, sentiment, and case detail. This allows customer care agents to empathize with customers and solve their issues faster.

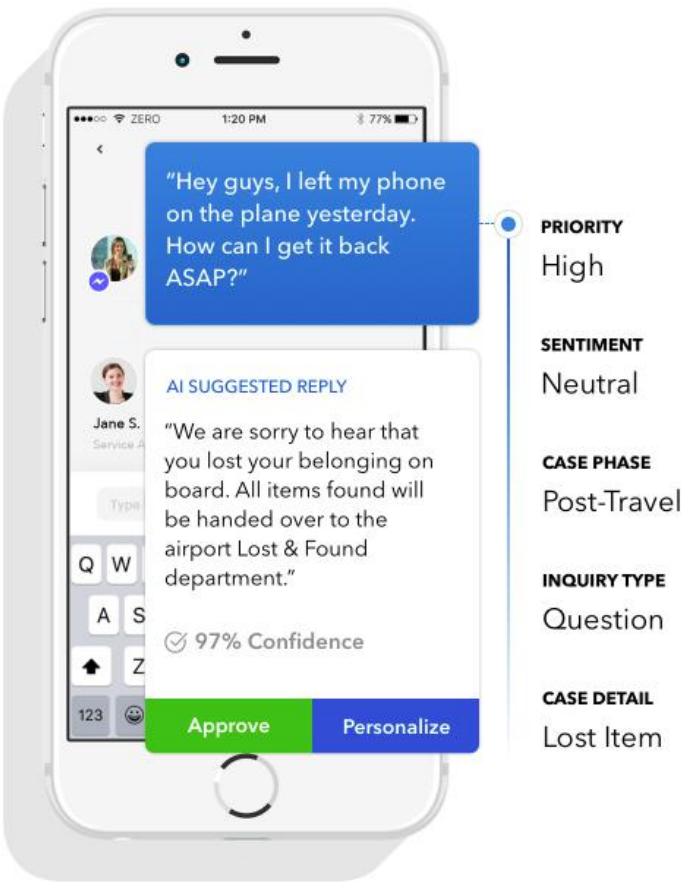


Figure : AI assistant for customer service agents, source: [DigitalGenius](#)

Above figure shows an application by Digital Genius. This application not only suggests simple answers to the question. It combines ML and NLP processing on the user's message, their data with the company, to provide various beneficial information for the agent. From the provided information the agent can then act accordingly and provide better query handling, increasing customer satisfaction. Using such assistant systems results in reduced ticket handling time and unnecessary repetitive tasks by over 50%, increasing customer and agent satisfaction.

Customer Service Analytics

Customer service analytics refers to the process of collecting and then analyzing customer data that gives meaningful insights regarding the company's standing, customer behavior and sentiment. Data analysts experts can generate useful information from customer data analytics and spread the information through visualization around the company, helping everyone in decision making and improving customer service.

Types of information

The information of your customers uncovered using data analytics can be divided into two categories:

- **Known unknowns**

Known unknowns are things we're aware but we don't know about. For example, how frequent or frequent our customers are? What is the popular product among certain age groups?

- **Unknown unknowns**

Unknown knowns are the things we're not aware of and things we don't know about. And we will miss out on these things such as how does one customer purchase a product or service? Is it due to discount, sales or seasonality?

Simple data analytics softwares without built in AI features works fine for extracting the known unknowns. However, the AI features such as NLP processing help extract the whys, the unknown unknowns from your customers data.

Types of data and metrics

For analytics, keeping track of data and metrics related to customers is a must. Metrics and data used for customer analytics fall under two categories:

- Quantitative metrics

These are numerical KPIs which help leaders keep track of customer support quality and customer experience. Some the widely used quantitative metrics for customer services are:

- Average first person response
- Average reply time
- Average number of replies

While metrics for customer experience are:

- Net promoter score(NPS)
- Customer satisfaction of customer support(CSAT))

Do you want to learn more about Qualitative metrics? Visit this [blog post](#) by [hiverrhq](#) regarding 18 customer service metrics and how to use them.

Though these metrics provide valuable insights , they don't uncover the unknown unknowns, the whys.

- Qualitative datas

The key behind finding the whys is qualitative data analytics. Quality data are for example open ended questions, content of **customer support tickets or Customer feedback surveys or even data from social listening**. And here is where AI systems with NLP processing comes to play in customer service analytics. NLP systems are required for information extraction from these unstructured data such as text and audios.

Types of data and metrics

Knowing the types of information, data and metrics isn't enough. Using customer data and metrics with various levels of tools/analytics, data analytics can be divided into four categories, listed with increasing complexity and insights gained.

- **Descriptive analytics**, which answers the "what" in the mind of leaders, such as what number of customers are aged between 20-29 age.
- **Diagnostic analytics**, which examines data to answer "why did it happen". These are more complex than descriptive analytics and utilize data discovery and data mining techniques.

Data discovery relates to methods that help us identify the data sources useful for interpreting the whys of certain results and Data mining refers to an automated process of gaining information from a large raw data set.

- **Predictive analytics**, which answers “why is likely to happen”, such as what is the sentiment of customers for fourth quarter of the year. Predictive analysis uses finding of both descriptive and diagnostics analytics to predict future trends, and is a value tool for forecasting
- **Prescriptive analytics**, which answers “what action should be taken?”. Using predictive analytics, you can eliminate future problems or take advantage of trends. Predictive analytics are sophisticated to implement and manage but are the most insightful and revenue generating for the company, such as recommendation system for product, services recommendation to end-users.

Use cases of Customer service analytics

- Identification of frequent topics and issues
- Detection of urgency
- Sentiment extraction
- Relevant word search
- Customer segmentation
- Product/services and advertisement recommendation

Workflow of customer segmentation(example)

Let’s discuss a bit on one of the use cases of customer service analytics, say customer segmentation. Customer segmentation refers to dividing your customers into multiple clusters or groups based on similar characteristics, such as age, gender, marital status, locations, etc., so that your company can market and target each group effectively. The four general steps of applying insights of segmentation for increment in customer service quality are shown in figure below:

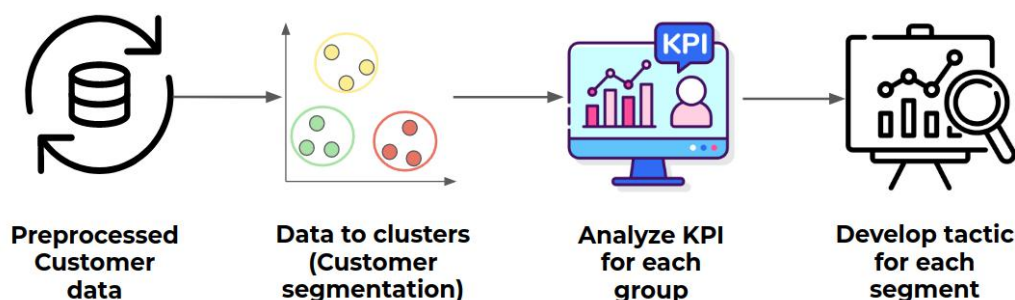


Figure : Procedure of using insights from customer segmentation

The steps goes are follows:

- First is **obtaining preprocessed customer data**, which has been gathered from multiple data sources such as the company's customer database, and issue tickets and then worked upon using preprocessing techniques.
- Next step is **customer segmentation**, where data is fed in data to a cluster method and customers are categorized into groups based on factors dedicated by the analyst.

if interested in customer segmentation, visit this [blog post](#) by hubspot regarding customer segmentation model, strategy and softwares.

- After segmentation comes analysis of the **KPI such as NPS** of each customer segment using visualization tools such as graphs and charts.
- Finally, from the graphical insight, companies can utilize this information to gain insights per group, such as finding the most revenue generating group. Then, **develop specific tactics per group**, example cross-selling or up-selling tactics for the highest revenue generating group.

Though extraction of information using data analytics and how you use it depends on your customer service department's need, always remember that you must share the findings with the correct teams within your business using [visualization tools](#). Visit the link to learn different types of visualization tools usable in data analysis.

Benefits of customer service analytics

Report by Harvard business named "[Real-time analytics](#)" states that 50% of business leaders who are investing in data analytics see an increase face in customer loyalty and retention as well as improved customer understanding.

Main reasons behind such increment are customer analytics help in:

- Understanding the customer journey and behavior better
- Identify customers pain points
- Monitor customer feedbacks
- Predict customer service analytics
- Measure overall customer satisfaction

Always remember to use customer data analytics for gaining edge in your company, improving efficiency of your entire customer department, ranging from managers to agents.

Challenges with AI in customer service

Within the customer service department, there are many challenges that the senior executives, the engineers, and the managers face in trying to implement AI within the company.

The main challenges within AI systems within customer service field are:

1. Lack of emotion and empathy

Major problem between customers and chatbot and virtual assistants might be they misunderstanding the emotion of the customer or failure to empathize with the callers. AI systems might be unable to gauge and understand the tone and context of a conversation.

2. Inability to localize a conversation

Another way AI systems help agents is by assisting customer agents. Say by translating customer service agent voice or text into the major language spoken by your customers. Such translations require ensuring all cultural nuances are taken care of. Such AI systems must ensure not to just simply translate the agent's reply word to word. This might be unachievable in current NLP processing AI systems.

3. System integration issues

Another challenge might be when integrating the new AI system with coexisting ones. AI systems are a big leap from traditional ones. As with any new tools, integrating them into an existing system is always a hassle. One issue could arise when a ICR is introduced into a support system and can't seem to route client issues to the optimal client, right? Engineers, data scientists and leaders must unite and carefully plan integration of AI with traditional systems.

4. Difficulty in acceptance of AI technology

The biggest difficulty with AI tech is the changes it brings to the table. Evolution is a difficult job, once AI enters the customer service department a lot of stuff changes. AI takes a lot of work out of customer service employees, and accordingly work requirements change. This might lead to frustration within the customer service department.

However, it's important to understand that the best type of support environment is one where live agents are working alongside AI. The opportunity to enhance skills of agents will be high within such environments.

We have reached the end of this read on AI in customer service, do tackle the tutorial and try to develop a simple customer service chatbot using RASA!!