

Chatbot Evaluation and Report

By: Aditi Chaudhari

Overview:

Star, the astrology chatbot, has two main functionalities. Firstly, she can attempt to guess what your zodiac sign is based on your personality traits. If she correctly guesses what your zodiac sign is, she will judge you based on your zodiac sign. Secondly, Star can give you random facts about any zodiac sign.

System Description:

In order to build Star, three distinct steps were taken: gathering the data and building the knowledge base through web scraping, training the models, and then building the chatbot.

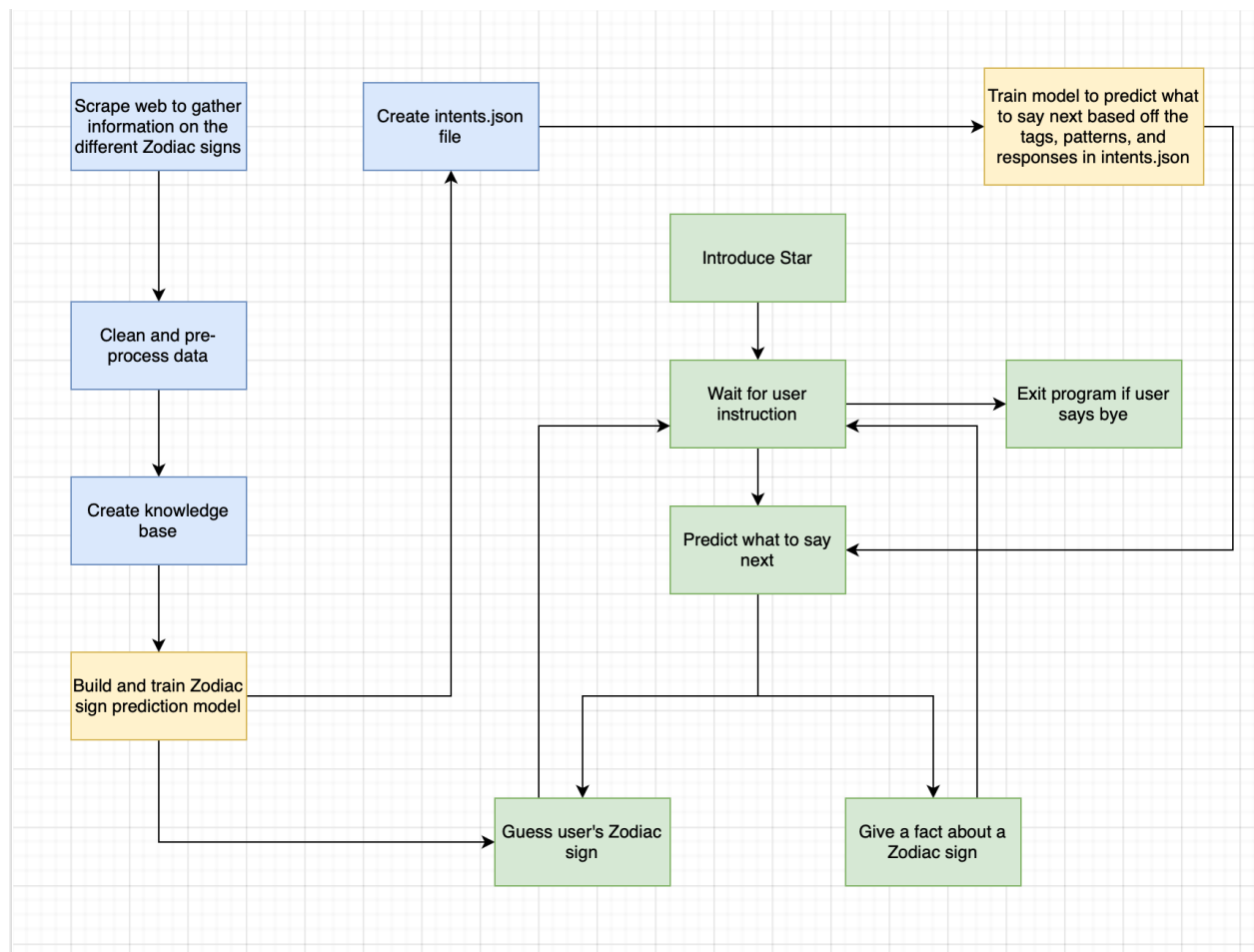
Building the Knowledge Base: To gather the data to build the knowledge base, information was scraped off the website <https://www.zodiacsign.com>. Given the starting website, the web scraper first crawled through all of the internal links on <https://www.zodiacsign.com> and then obtained information from each page corresponding to a zodiac sign, totaling 12 total web pages scraped. The web scraper wrote all the text from each page to a corresponding .txt file. It then cleaned the data by gathering only the relevant information.

Training the Models: After the relevant data was gathered, it had to be pre-processed before it could be used to train the models. For each file containing information on a zodiac sign, all newlines and tabs were removed. Then, sentences were extracted using `nltk.sent_tokenize()`. These sentences were saved in new .txt files for future use. After extracting sentences, word tokens were extracted using `nltk.word_tokenize()`. Stop words, custom stop words, and punctuation were removed. Finally, a CSV file was made with each row containing a column with the pre-processed text and what zodiac sign that text corresponds to. After pre-processing the text, the data was used to train a model to predict a user's zodiac sign is. The text was vectorized using a `tfidf` vectorizer and the labels were encoded using integer encoding. These were used to train a Linear Support Vector Classification model, which yielded a 22% accuracy. Many different models were tried (including Naïve Bayes, logistic regression, random forest, etc.), but Linear SVC performed the best. The data set was small and distributed, so the models didn't perform that well. But, ultimately, Star guesses for fun, not for accuracy since astrology is a pseudoscience. Next, the model to predict what the user input can be categorized as needed to be built and trained. I built the `intents.json` file (which contained a list of intents, each intent having a tag, pattern, and response) from scratch based on the knowledge base to train the model. I learned a new technique called bag of words that is like `tfidf` but does not give information on the less important words. I experimented with both bag of words and `tfidf` for training my model, but ultimately chose to use bag of words since it can perform better for smaller pieces of text. After creating a bag of words from the `intents.json` file, the bag of words was used to train a Keras Sequential model for 200 epochs, yielding about 95% accuracy.

Building the Chatbot: Star first introduces herself. If she has met the user before, she welcomes them back and she remembers the user's zodiac sign using the user model. If she hasn't met the user before, she introduces herself. She then waits for the user's instruction. After the user gives instruction, Star uses her machine learning model to predict what to say next. If the user asks for a fact on a specific zodiac sign, she gives them the fact. If the user asks for Star to predict their zodiac sign, she uses her other machine learning model to make the prediction. Any information gathered by Star about the user's personality is saved in the user model.

Diagram of the Logic:

A diagram of the logic can be seen below. The color blue corresponds to building the knowledge base, the color yellow corresponds to training the models, and the color green corresponds to building the chatbot.



Sample Dialog Interaction:

A sample dialog interaction can be seen below:

Star: hi... my name is star. what is your name?

User: lauren

Star: hello, lauren! i don't believe we've met before. i am an AI astrology chatbot that can guess your zodiac sign or tell you random facts about the different zodiac signs. how can i help you today?

User: can you guess my star sign?

Star: sure. what are your personality traits?

User: i am curious, ambitious, and extroverted.

Star: hmmm... based on my calculations, you are a leo. am i correct?

User: no

Star: my bad. tell me more about yourself

User: i am difficult, friendly, and emotional

Star: further calculations reveal that you are a capricorn. am i correct?

User: yes

Star: i feel like it must get tiring being so dark and depress-y all the time. how else can i help you?

User: oh

Star: what?

User: can you tell me about capricorns?

Star: Capricorns learn from their mistakes and rely on their experience and expertise to achieve success.

User: okay. thank you. bye

Star: come back again!

If the user Lauren were to chat with Star again, Star would remember what Lauren's star sign is, as seen below:

Star: hi... my name is star. what is your name?

User: lauren

Star: welcome back, lauren! i remember that you're a capricorn. how can i help you today?

User: what are the personality traits of leos?

Star: Leos are capable of achieving anything they set their minds to in all aspects of their lives.

User: what about sagittariuses?

Star: As extroverts, they are optimistic, enthusiastic, and always ready for change.

User: can you tell me what scorpions are like?

Star: Scorpions are often calm and mysterious, with a deep understanding of the rules of the universe that gives them power that others may not recognize.

User: how do pisces navigate the world?

Star: Pisces individuals are characterized by empathy and incredible emotional capacity, but only if they maintain strong boundaries and do not let external emotions overwhelm them.

User: cancers?

Star: Intuitive and compassionate, they may be challenging to understand from a purely rational perspective.

User: thank you for your help star. bye

Star: see you soon!

Evaluation of the Chatbot:

As with any chatbot, Star has its strengths and weaknesses. A major strength of Star is that she can try to predict what the user's zodiac sign is. When ChatGPT was asked to do the same thing, it refused, claiming that astrology is a pseudoscience. Of course, ChatGPT isn't wrong, and this points to a weakness of Star. It is unlikely that she can accurately predict someone's zodiac sign based on their personality traits because someone's personality traits don't actually correspond to their zodiac sign in real life. Star's machine learning model that she uses to guess someone's zodiac sign isn't that accurate (it has an accuracy of approximately 22%) since there are many zodiac signs and it was trained on a small data set, yet I did not seek to make the model more accurate because 1) astrology is a pseudoscience and 2) this chatbot is simply for fun.

Another strength of Star is that she is informed about every zodiac sign. When you ask her to tell you what a zodiac sign is like, she will respond accurately. However, she cannot answer specific questions about each zodiac sign, and that is her weakness. If you ask her a question like "what are the personality traits of a Capricorn?" she will respond well, but if you ask her "who are Capricorns compatible with?" she will not give you a good answer.

Appendix for the Knowledge Base:

The knowledge base was created using a web scraper that scraped text from <https://www.zodiacsign.com>. It visited each zodiac sign's page on this website and created a corresponding .txt file of all the sentences that were present. Certain sentences from each .txt file were chosen to populate knowledge base. Aside from knowledge on each sign, generic responses such as 'goodbye' were also added in. The knowledge base can be seen below:

```
{
  "intents": [
    {
      "tag": "bye",
      "patterns": ["bye", "see you later", "goodbye"],
      "response": ["goodbye!", "see you soon!", "come back again!"]
    },
    {
      "tag": "predict",
      "patterns": ["can you tell me my zodiac sign", "tell me my zodiac sign", "guess my zodiac sign", "what is my zodiac sign", "predict my zodiac sign"],
      "response": ["sure. tell me about yourself...", "sure. what are your personality traits?", "sure. what are you like?"]
    },
    {
      "tag": "no",
      "patterns": ["no", "nope", "absolutely not", "not at all"],
      "response": ["i'm sorry, do you want to tell me more about yourself?", "my bad. tell me more about yourself", "i need more data. tell me more about yourself"]
    },
    {
      "tag": "yes",
      "patterns": ["yes", "yup", "correct", "absolutely", "indeed", "certainly", "sure", "of course", "yeah", "okay"],
      "response": ["someone once told me to never trust a virgo man... i hope you aren't a man. so, how else can i help you?", "maybe y'all should learn to be less stubborn... i know you won't tho. how
```

else can i help you?",
"make a decision for once in your life. how else can i help you?",
"y'all don't have to be so cold and emotionless all the time. how else can i help you?",
"there is no need to be so angry all the time... like calm down. how else can i help you?",
"y'all are the biggest cry babies. how else can i help you?",
"doja cat said \"can't trust a big butt or a gemini\"... idk how i feel about you. how else can i help you?",
"the astrology app co-star thinks you'd make a good 'sad clown.' do with that what you will. how else can i help you?",
"you know, y'all don't always have to say whats on your mind. how else can i help you?",
"king of the jungle? more like king of vanity. y'all are too self-absorbed. how else can i help you?",
"i either get along very well with scorpios or i hate them. i guess we'll find out which. how else can i help you?",
"i feel like it must get tiring being so dark and depress-y all the time. how else can i help you?"]},

{"tag": "empty",
"patterns": [""],
"response": ["what?", "huh?", "come again?"]},

{"tag": "aquarius",
"patterns": ["what are aquarius like?", "tell me about aquarius", "tell me a fact about aquarius"],
"response":
["Aquarians are visionaries and are always ready for change, known for their intellectual abilities and for shaking up the world once they're in it.",
"As a sign of freedom and solitude, Aquarius can be too difficult to be with for some static and passive signs of the zodiac.",
"They are visionaries who like to engage in humane activities and need to work in a place that supports better circumstances for endangered groups of people.",
"Uranus is the ruler of Aquarius, with its traditional ruler Saturn by its side.",
"They can see people without prejudice, making them truly special.",
"Although they can easily adapt to the energy that surrounds them, Aquarius representatives have a deep need for alone time to restore their power.",
"They are often in positions of power, and their issues with authority usually stem from their relationship with other people rather than the leadership structure itself.",
"There's nothing that can attract them more than an interesting conversation.",
"Integrity and honesty are essential for anyone who wants to remain in their life, and feelings won't have much to do with how they treat betrayal and those who let them down along the way.",
"As a sign of freedom and solitude, Aquarius can be too difficult to be with for some static and passive signs of the zodiac."]},

{"tag": "aries",
"patterns": ["what are aries like?", "tell me about aries", "tell me a fact about aries"],
"response":
["An Aries is ready to be the hero of the day, to fly away and carry many

endangered and powerless people on their back.",

"When in love, Aries may shower their loved one with affection, sometimes excessively, while forgetting to check the information they receive in return.",

"Aries is a passionate lover, and can sometimes become addicted to the pleasures of the flesh and sexual encounters. Their opposing sign is Libra, which is the sign of relating, tact, and diplomacy, and represents the furthest point from their natural personality.",

"They are continuously seeking dynamic experiences, speed, and competition, always striving to be first in everything from work to social gatherings.",

"They are naturally brave, rarely afraid of trial and risk, and possess youthful strength and energy, regardless of their age, allowing them to quickly perform any given task.",

"They tend to express their feelings to the person they are in love with without giving it much thought.",

"They are very passionate, energetic, and love adventures.",

"The compatibility of Aries with other signs of the zodiac can be very complex.",

"Each Aries has the task of willingly sharing their position, power, gold, or physical strength with others, or else the energy will be stopped in its natural flow, fear will take over, and the process of giving and receiving will hold balance at zero.",

"It is in their nature to take action, sometimes before thinking things through. The Sun's position in such high dignity gives them excellent organizational skills, and it's rare to meet an Aries who isn't capable of finishing several tasks at once."]},

{ "tag": "cancer",

"patterns": ["what are cancer like?", "tell me about cancer", "tell me a fact about cancer"],

"response":

["They are highly emotional and sensitive, and prioritize matters related to family and home.",

"The compassion and understanding that Cancer bestows upon their loved ones should never be taken for granted, or they will make it clear that you are not a good match for them in the long run.",

"Above all, they prefer socializing in their homes, where they can create an intimate atmosphere and share deep understandings under their control.",

"They are resourceful and skilled in managing time and finances, often overseeing all household finances and controlling their partner or other family members' spending.",

"Intuitive and compassionate, they may be challenging to understand from a purely rational perspective.",

"Those born with their Sun in Cancer are very loyal and empathetic to the pain and suffering of others.",

"As a Water sign, just like Scorpio and Pisces, Cancer is guided by their emotions and heart, and can have difficulty fitting into the world around them.",

"As children, they lack coping and defensive mechanisms for the outer world, and require care and understanding to navigate it successfully.",

"They know where they are going, but sometimes find themselves heading in the wrong direction until they learn their lessons and begin to rely solely on themselves.",

"In their partners, they seek someone who can understand them through non-verbal communication, shared daily routines, and a deep emotional connection."]},

```
{ "tag": "capricorn",
  "patterns": ["what are capricorn like?", "tell me about capricorn", "tell me a fact about capricorn"],
  "response":
    ["Capricorn individuals are typically traditional and serious in nature, possessing an inner sense of independence that allows them to make significant progress in both their personal and professional lives.",
     "Capricorns face the world with bravery, never running away but constantly battling their inner monsters in secrecy.",
     "Capricorns are not likely to collect too many friends in their lifetime, but they will turn to those who make them feel at peace, intelligent, and honest at all times.",
     "Capricorns learn from their mistakes and rely on their experience and expertise to achieve success.",
     "They are skilled in self-control, can make realistic plans, and are capable of managing many people who work for them.",
     "They may struggle with feelings of guilt and become fixated on the past.",
     "Capricorns are always ready to transform themselves to confront and conquer their fears.",
     "Capricorns are focused on their personal goals and can sometimes lack compassion and emotional connection in their relationships.",
     "They are dedicated to providing the stability of a \"normal\" life and their partner can rely on them as a stepping stone for personal endeavors, and they can have a lasting bond with a constant tendency for growth.",
     "Capricorns are known for setting high standards for themselves and are characterized by their honesty, dedication, and perseverance." ] },

{ "tag": "gemini",
  "patterns": ["what are gemini like?", "tell me about gemini", "tell me a fact about gemini"],
  "response":
    ["Their curiosity about the world knows no bounds, and they often feel like there is not enough time to experience everything they want to see.",
     "Geminis need excitement, variety, and passion in their relationships and may spend a lot of time with different lovers until they find the right one.",
     "Geminis have an abundance of social contacts and love to engage in conversations, searching for understanding, and always looking for strong-willed people to communicate with.",
     "They need a workplace that won't keep them stuck in routine or a repetitive task that goes not allow them to shine.",
     "Even though they might believe that money is just a necessary evil, most Gemini's will not spend much time thinking about where to earn it or how to spend it.",
     "They are sociable, communicative, and always ready for fun, but can suddenly become serious, thoughtful, and restless.",
     "Gemini-born individuals often feel like they are missing their other half, constantly seeking new friends, mentors, colleagues, and people to talk to.",
     "With their changeable and open mind, Geminis excel in creative fields, such as writing and journalism, and they also shine in trade, driving, and team sports.",
     "Gemini are versatile, inquisitive, fun-loving and born with a deep desire to experience everything that the world has to offer.",
     "Inquisitive and always ready to flirt, a Gemini could spend a lot of time with different lovers until they find the right one who can match their intellect and energy." ] },
```

```
{
  "tag": "leo",
  "patterns": ["what are leo like?", "tell me about leo", "tell me a fact about leo"],
  "response": [
    "They possess qualities such as creativity, self confidence, dominance and a strong presence that is hard to resist.",
    "Leos are associated with the element of Fire, along with Aries and Sagittarius.",
    "Leos are capable of achieving anything they set their minds to in all aspects of their lives.",
    "Leo is strong and reliable with the ability to connect with almost everyone and the energy to host celebrations and events with people who bring out the best in them.",
    "Once they dedicate themselves to their work, they strive for perfection.",
    "A Leo needs a partner who is self-aware, reasonable, and on the same intellectual level as them.",
    "They are ambitious, creative, and optimistic.",
    "Leos love to be surrounded by modern and trendy things.",
    "They are extremely generous and may provide financial help to many friends, supporting them through difficult times.",
    "Jobs that allow for open expression of artistic talent, such as acting and entertainment, are ideal for Leos."
  ]
},
```

```
{
  "tag": "libra",
  "patterns": ["what are libra like?", "tell me about libra", "tell me a fact about libra"],
  "response": [
    "Libra is an Air sign situated between Gemini and Aquarius, providing these individuals with constant mental stimulation, a strong intellect, and a sharp mind.",
    "Librans work well in a group and can be convincing and gifted speakers.",
    "They can be beloved leaders, even though they sometimes lack the initiative needed to organize people who work for them.",
    "It is the gravity of Libra to share their entire life with someone, while also challenging themselves to be independent and aware of their core personality.",
    "In a way, each Libra is in search of a partner who can set clear boundaries, protecting them without endangering their pride in the process.",
    "Librans are fascinated by balance and symmetry, and they are constantly striving for justice and equality, realizing that the most important thing in life is their own inner personality.",
    "They are inspired by good books, engaging discussions, and individuals who have a lot to say.",
    "They need to enrich their lives with music, art, and beautiful places that they have the opportunity to visit.",
    "There is something incredibly uncertain about Libra, as if they are unsure which side to choose next, recognizing that life's experiences teach us to be careful around others.",
    "Once they enter into a romantic relationship, maintaining peace and harmony becomes their primary goal."
  ]
},
```

```
{
  "tag": "pisces",
  "patterns": ["what are pisces like?", "tell me about pisces", "tell me a fact about pisces"],
  "response": [
    "Pisces individuals are characterized by empathy and incredible emotional capacity, but only if they maintain strong boundaries and do not let external
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emotions overwhelm them.",
"Pisces individuals are connected to art, music, and any form of liberal expression, and every representative of this sign possesses a talent they need to use to feel creative and free.",
"They often make excellent priests, doctors, veterinarians, musicians, painters and any career that involves working behind the scenes.",
"They tend to focus on their dreams and goals and will only strive to earn enough money to achieve them.",
"They tend to prioritize the needs of others over their own which is not healthy for anyone.",
"Fear can drive Pisces individuals away from loved ones, push them into romance, or leave them feeling unwilling and powerless.",
"Pisces individuals are typically gentle and extremely generous with their partners, but in their search for love, they may sometimes compromise their moral values.",
"Short-term relationships and adventures are not common for this zodiac sign, although they possess a changeable quality that enables them to be carefree when selecting a new daily fling.",
"Once they establish a deep connection with someone, they become fiercely loyal and honest, as if their sole purpose in life is to find the person standing in front of them and make them happy.",
"Money is not usually a top priority for Pisces."]],

```
{ "tag": "sagittarius",  
  "patterns": ["what are sagittarius like?", "tell me about sagittarius",  
    "tell me a fact about sagittarius"],  
  "response":  
    ["As extroverts, they are optimistic, enthusiastic, and always ready for  
change.",  
    "Sagittarius individuals seek partners who are intellectual and can  
stimulate all of their senses, while also being gentle yet firm in their  
opinions and choices.",  
    "Sagittarius individuals are generous and kind and as long as they keep  
their life philosophies in check and make time to laugh, they make great  
friends.",  
    "Jobs that suit Sagittarius individuals include those of a travel agent,  
photographer, researcher, ambassador, and freelance activities that allow  
them to organize their own time.",  
    "Being adventurous and always willing to try new things, Sagittarius  
individuals may struggle to distinguish between friendships and love, or  
between love and sexual relationships.",  
    "Despite being blessed with many incredible things, Sagittarius individuals  
may still feel like something is missing to make their life complete.",  
    "Pain is often hidden behind their smile, and they would willingly give  
everything they have to help others heal, and seek a life free from pain.",  
    "Their open mind and philosophical views drive them to explore the world in  
search of the meaning of life.",  
    "Like Aries and Leo, Sagittarius is a Fire sign that seeks to creatively  
color the world in their unique way.",  
    "They are clear about their intentions and have a strong moral compass,  
which can sometimes make them overly honest and lacking in tact and  
consideration for others."]]},
```

```
{ "tag": "scorpio",  
  "patterns": ["what are scorpio like?", "tell me about scorpio", "tell me a  
fact about scorpio"],  
  "response":
```

["Scorpios are great leaders and guides who are resourceful, dedicated and fearless when faced with challenges.",
"Scorpios are often calm and mysterious, with a deep understanding of the rules of the universe that gives them power that others may not recognize.",
"Scorpios can be dedicated and faithful, but at times, they may become obsessive, possessive, and overwhelming.",
"Scorpios understand that change is the only constant in the Universe and accept it in all their relationships.",
"The best career choices for Scorpios are in scientific and research fields, and they make excellent detectives, police officers, psychologists, and surgeons.",
"As a Water sign, Scorpios, like Cancer and Pisces, experience, express, and confront their emotions.",
"With deep self-awareness, Scorpios uncover ways to confront their deepest, darkest motives and to hide their talents and dark desires.",
"They may engage in casual one-night stands and relationships that do not fulfill their emotional needs, but this lifestyle will not make them happy for long.",
"Scorpios are on a quest to find their perfect match, seeking to become one with their loved ones.",
"They are dedicated, loyal, and intelligent, and enjoy the company of witty and fun individuals who bring love and color into their lives."]],

{ "tag": "taurus",
 "patterns": ["what are taurus like?", "tell me about taurus", "tell me a fact about taurus"],
 "response":
 ["Taurus makes great employees, long-term friends, and partners, as they are always there for the people they love.",
 "Taurus has a grounded, practical, and realistic perspective.",
 "Taurus often feels a sense of unease, as if something is constantly reminding them of past happiness, and they may retreat into their own world, feeling lonely and disconnected from their true selves.",
 "To find love and happiness, Taurus individuals need to travel the world, shift their perspective, or make changes to their belief system and values.",
 "Taurus individuals often show and receive attention through gifts and material things.",
 "They have a strong desire to be surrounded by love and beauty, and are drawn to the material world, hedonism, and physical pleasures.",
 "They are also known for being stable and conservative, making them one of the most dependable signs of the zodiac.",
 "Taurus is an Earth sign, Like Virgo and Capricorn.",
 "Their determination and commitment are often mistaken for stubbornness, but they simply have a strong sense of responsibility.",
 "Taurus individuals are loyal and don't like sudden changes, criticism, or feeling guilty."]]},

{ "tag": "virgo",
 "patterns": ["what are virgo like?", "tell me about virgo", "tell me a fact about virgo"],
 "response":
 ["As an Earth sign, Virgos fit perfectly between Taurus and Capricorn, giving them a strong character that favors conservative, well-organized things and practicality in everyday life.",
 "Many Virgos may choose to pursue careers as writers, journalists, and typists, but their desire to serve others makes them natural caregivers who feel a sense of purpose in helping others.",

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    "Trust needs to be earned with Virgo slowly and steadily, and each partner
    in their life has the opportunity to be nurtured and cared for, but only if
    they give enough to deserve Virgo's special treatment.",
    "When they focus on something, perfection is expected, as no other sign has
    such an eye for detail as Virgo.",
    "Virgos are naturally inclined to save money and tend to value practical
    and useful things.",
    "They lead organized lives, and even when things become chaotic, their
    goals and dreams are still strictly defined in their mind.",
    "Although Virgos may not always express their feelings directly, intimacy
    allows them to beautifully express their emotions.",
    "Virgos prefer stable relationships rather than casual flings, although
    they may resort to using their charm and superficial communication to win
    people's hearts without investing much of their own emotions.",
    "From their cloud, they came to Earth with a mission to use their existence
    for good and discover justice and purity in other people.",
    "Their concern for details is so strong that they can become overly
    critical and concerned about matters that others may not care much about,
    constantly worried that they might have missed something that cannot be
    fixed." ] }
  ] }
}

```

Appendix for the User Models:

The user model is a dictionary that collects information on the user. The key for the dictionary is the user's name, and the value of the key is a list that describes the user. The first element of the list will either be the user's zodiac sign if Star was able to correct guess it or it will be an empty string if Star hasn't guessed it. The corresponding entries in the list will be user-inputted descriptions of themselves. A sample user model can be seen below:

```

{
  'aditi': [
    'capricorn',
    'i am difficult',
    'i am happy',
    'i am hardworking and difficult',
    'i enjoy working hard but can be pessimistic',
    'i love coding',
    'i am introverted',
  ],
  'adiddlydoo': [
    'gemini',
    'i hate people. i really like keeping to myself.',
    'i am so introverted',
    'i really like peace and quiet',
    "i am shy, don't like talking to people"
  ],
  'lauren': [
    'pisces',
  ],
}

```

```
    'i am charismatic, outgoing, and friendly',  
    'i am artistic, creative, and bubbly'  
  ],  
  'cara': [],  
  'chatgpt': [  
    'scorpio',  
    'i am assertive, witty, and reserved'  
  ]  
}
```