Untitled

July 23, 2023

1 First Aid Recommendation ChatBot

this bot helps you find treatment for your case quickly

[94]:
```
# importing libraries
import json
import numpy as np
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Embedding, GlobalAveragePooling1D
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from sklearn.preprocessing import LabelEncoder
```

let me try to describe how to do **chatbot** as an idea

first, we need to find data and separate it into `inputs` and `outputs` user will give me a **sentence** fine the `inputs` of the model may be lots of `sentences` and of course, I need labels to act each sentence to use it as the target the response of the bot may be any answer **connected** with the labels and the sentences let's try it step by step

data collected from Kaggle competition (**First Aid Recommendations Intents**)

this data is structured so I used it

it has

tag » labels

patterns » sentence input

responses » sentence output of chat

[95]:
```
intents={"intents": [
        {"tag": "greeting",
         "patterns": ["Hi", "Hey", "Is anyone there?", "Hello", "Hay"],
         "responses": ["Hello", "Hi", "Hi there"]
        },
        {"tag": "goodbye",
         "patterns": ["Bye", "See you later", "Goodbye"],
```

```
        "responses": ["See you later", "Have a nice day", "Bye! Come back␣
↪again"]
      },
      {"tag": "thanks",
       "patterns": ["Thanks", "Thank you", "That's helpful", "Thanks for the␣
↪help"],
       "responses": ["Happy to help!", "Any time!", "My pleasure", "You're␣
↪most welcome!"]
      },
      {"tag": "about",
       "patterns": ["Who are you?", "What are you?", "Who you are?" ],
       "responses": ["I.m ammar_bot, your ammar_bot assistant", "I'm␣
↪ammar_bot, an Artificial Intelligent bot"]
      },
      {"tag": "name",
      "patterns": ["what is your name", "what should I call you", "whats your␣
↪name?"],
      "responses": ["You can call me ammar_bot.", "I'm ammar_bot!", "Just␣
↪call me as ammar_bot"]
      },
      {"tag": "help",
      "patterns": ["Could you help me?", "give me a hand please", "Can you␣
↪help?", "What can you do for me?", "I need a support", "I need a help",␣
↪"support me please"],
      "responses": ["Tell me how can assist you", "Tell me your problem to␣
↪assist you", "Yes Sure, How can I support you"]
      },
      {"tag": "createaccount",
      "patterns": ["I need to create a new account", "how to open a new␣
↪account", "I want to create an account", "can you create an account for me",␣
↪"how to open a new account"],
      "responses": ["You can just easily create a new account from our web␣
↪site", "Just go to our web site and follow the guidelines to create a new␣
↪account"]
      },
      {"tag": "complaint",
      "patterns": ["have a complaint", "I want to raise a complaint", "there␣
↪is a complaint about a service"],
      "responses": ["Please provide us your complaint in order to assist␣
↪you", "Please mention your complaint, we will reach you and sorry for any␣
↪inconvenience caused"]
      },


      {"tag": "Cuts",
```

```
        "patterns": ["What to do if Cuts?", "How to cure Cuts?", "Which␣
↪medicine to apply for Cuts?", "what to apply on cuts?", "Cuts"],
        "responses": ["Wash the cut properly to prevent infection and stop the␣
↪bleeding by applying pressure for 1-2minutes until bleeding stops. Apply␣
↪Petroleum Jelly to make sure that the wound is moist for quick healing.␣
↪Finally cover the cut with a sterile bandage. Pain relievers such as␣
↪acetaminophen can be applied."],
        "context_set": ""
       },

       {"tag": "Abrasions",
        "patterns": ["how do you treat abrasions?", "Do Abrasions cause scars?
↪", "Abrasions", "what to do if abrasions?", "Which medicine to apply for␣
↪abrasions?", "How to cure abrasions?"],
        "responses": ["Begin with washed hands.Gently clean the area with cool␣
↪to lukewarm water and mild soap. Remove dirt or other particles from the␣
↪wound using sterilized tweezers.For a mild scrape that's not bleeding, leave␣
↪the wound uncovered.If the wound is bleeding, use a clean cloth or bandage,␣
↪and apply gentle pressure to the area to stop any bleeding.Cover a wound␣
↪that bled with a thin layer of topical antibiotic ointment, like Bacitracin,␣
↪or a sterile moisture barrier ointment, like Aquaphor. Cover it with a clean␣
↪bandage or gauze. Gently clean the wound and change the ointment and bandage␣
↪once per day.Watch the area for signs of infection, like pain or redness and␣
↪swelling. See your doctor if you suspect infection."],
        "context_set": ""
       },

       {"tag": "stings",
        "patterns": ["How do you treat Sting?", "Stings", "What to do if you␣
↪get a sting?", "Which medicine to apply if sting?"],
        "responses": ["Remove any stingers immediately. Some experts recommend␣
↪scraping out the stinger with a credit card. Applying ice to the site may␣
↪provide some mild relief. Apply ice for 20 minutes once every hour as needed.
↪ Wrap the ice in a towel or keep a cloth between the ice and skin to keep␣
↪from freezing the skin. Taking an antihistamine such as diphenhydramine␣
↪(Benadryl) or a nonsedating one such as loratadine (Claritin) will help with␣
↪itching and swelling. Take acetaminophen (Tylenol) or ibuprofen (Motrin)for␣
↪pain relief as needed. Wash the sting site with soap and water. Placing␣
↪hydrocortisone cream on the sting can help relieve redness, itching, and␣
↪swelling."],
        "context_set": ""
       },

       {"tag": "Splinter",
```

```
        "patterns": ["How to remove Splinters", "How to cure Splinters?",␣
↪"What to do if I have splinters?", "How do you bring a splinter to the␣
↪surface?"],
        "responses": ["1. SOAK IT IN EPSOM SALTS. Dissolve a cup of the salts␣
↪into a warm bath and soak whatever part of the body has the splinter.␣
↪Failing that, you can also put some of the salts onto a bandage pad and␣
↪leave it covered for a day; this will eventually help bring the splinter to␣
↪the surface. 2. VINEGAR OR OIL. Another simple way to draw out that stubborn␣
↪splinter is to soak the affected area in oil (olive or corn) or white␣
↪vinegar. Just pour some in a bowl and soak the area for around 20 to 30␣
↪minutes,"],
        "context_set": ""
       },

       {"tag": "Sprains",
        "patterns": ["How do you treat a sprain?", "what to do if i get a␣
↪sprain?", "Which cream to apply if i get a sprain?", "Which medicine to␣
↪apply if I get a sprain?"],
        "responses": ["Use an ice pack or ice slush bath immediately for 15 to␣
↪20 minutes and repeat every two to three hours while you're awake. To help␣
↪stop swelling, compress the ankle with an elastic bandage until the swelling␣
↪stops. In most cases, pain relievers - such as ibuprofen (Advil, Motrin IB,␣
↪others) or naproxen sodium (Aleve, others) or acetaminophen (Tylenol,␣
↪others) are enough to manage the pain of a sprained ankle."],
        "context_set": ""
       },

       {"tag": "Strains",
        "patterns": ["How do you treat a strain?", "what to do if i get a␣
↪strain?", "Which cream to apply if i get a strain?", "Which medicine to␣
↪apply if I get a strain?", "How do you diagnose a strain?", "Is heat or ice␣
↪better for a pulled muscle?"],
        "responses": ["Rest,Ice,Compression and Elevation can be used to cure␣
↪strains. Avoid using your muscle for a few days, especially if movement␣
↪causes an increase in pain and also Apply ice immediately after injuring␣
↪your muscle. This will minimize swelling. Don't put ice directly on your␣
↪skin. Use an ice pack or wrap ice in a towel. To reduce swelling, wrap the␣
↪affected area with an elastic bandage until swelling comes down."],
        "context_set": ""
       },

       {"tag": "Fever",
        "patterns": ["How do you treat a mild Fever?", "what to do if i get a␣
↪mild fever?", "Which medicine to take if I get a mild fever?", "fever"],
```

```
        "responses": ["To treat a fever at home: 1)Drink plenty of fluids to␣
↪stay hydrated. 2)Dress in lightweight clothing. 3)Use a light blanket if you␣
↪feel chilled, until the chills end. 4)Take acetaminophen (Tylenol, others)␣
↪or ibuprofen (Advil, Motrin IB, others). 5) Get medical help if the fever␣
↪lasts more than five days in a row."],
        "context_set": ""
       },

       {"tag": "Nasal Congestion",
        "patterns": ["How do you treat nasal Congestion?", "what to do if i␣
↪get a nasal congestion?", "Which medicine to take if I have a nasal␣
↪congestion?", "what to do if i have a blocked nose?", "How do you treat a␣
↪blocked nose?", "How long does nasal congestion last?"],
        "responses": ["When you're stuffed up, focus on keeping your nasal␣
↪passages and sinuses moist. To keep your nasal passages moist, you can:␣
↪1)Use a humidifier or vaporizer. 2)Drink lots of fluids. This will thin out␣
↪your mucus, which could help prevent blocked sinuses. 3)Place a warm, wet␣
↪towel on your face. It may relieve discomfort and open your nasal passages.
↪"],
        "context_set": ""
       },

       {"tag": "Cough",
        "patterns": ["How to cure cough?","How do you treat cough?", "what to␣
↪do if i get a cough?", "Which medicine to take if I get cough?", "How do you␣
↪get rid of cough?"],
        "responses": ["1) Honey:- Use honey to treat a cough, mix 2 teaspoons␣
↪(tsp) with warm water or an herbal tea. Drink this mixture once or twice a␣
↪day. Do not give honey to children under 1 year of age. 2) Ginger:- Brew up␣
↪a soothing ginger tea by adding 20-40 grams (g) of fresh ginger slices to a␣
↪cup of hot water. Allow to steep for a few minutes before drinking. Add␣
↪honey or lemon juice to improve the taste and further soothe a cough. 3)␣
↪Fluids:- Staying hydrated is vital for those with a cough or cold. Research␣
↪indicates that drinking liquids at room temperature can alleviate a cough,␣
↪runny nose, and sneezing."],
        "context_set": ""
       },

       {"tag": "Sore Throat",
        "patterns": ["How do you treat sore throat?", "what to do if i get a␣
↪sore throat?", "Which medicine to take if I get a sore throat?", "How to␣
↪cure sore throat?"],
```

```
        "responses": ["1) Make sure you get plenty of rest and drink a lot of␣
↪fluids. 2)Inhale steam,Run hot water in a sink.Drape a towel over you to␣
↪trap the steam, and have the person lean over the sink with the water␣
↪running. Tell him to breathe deeply through his mouth and nose for 5 to 10␣
↪minutes. Repeat several times a day. 3)Have him sip chicken broth or warm␣
↪tea with honey. Don't give honey to a child under 12 months of age."],
        "context_set": ""
       },

       {"tag": "Gastrointestinal problems",
        "patterns": ["How do you treat gas problems?", "what to do if i have␣
↪Gastrointestinal problems?", "Which medicine to take if I get gas problem?",␣
↪"How to cure Gas problems?"],
        "responses": ["1) Replenish body fluids 2)Do not take antidiarrheal␣
↪drugs or laxatives or pain medication, unless specified by a medical␣
↪professional.3)Taking antacids may help, per recommendation of a healthcare␣
↪professional. 4)If prone to frequent heartburns, seek medical help. 5)Taking␣
↪meals that are not spicy regularly, can relieve ulcer pains. 6)Seek medical␣
↪help, if conditions persist or continue to worsen"],
        "context_set": ""
       },

       {"tag": "Skin problems",
        "patterns": ["How do you treat Skin problems?", "what to do if i get a␣
↪skin allergy?", "Which medicine to take if I get a skin allergy?", "How to␣
↪cure skin allergy?"],
        "responses": ["1)Hydrocortisone cream. 2)Ointments like calamine␣
↪lotion. 3)Antihistamines. 4)Cold compresses. 5)Oatmeal baths. 6)Talk to your␣
↪doctor about what's best for your specific rash."],
        "context_set": ""
       },

       {"tag": "Abdonominal Pain",
        "patterns": ["How do you treat Abdonominal Pain?", "what to do if i␣
↪get a Abdonominal Pain?", "Which medicine to take if I get a Abdonominal␣
↪Pain?", "How to cure Abdonominal Pain?"],
        "responses": ["1)Provide clear fluids to sip, such as water, broth, or␣
↪fruit juice diluted with water. 2)Serve bland foods, such as saltine␣
↪crackers, plain bread, dry toast, rice, gelatin, or applesauce. 3)Avoid␣
↪spicy or greasy foods and caffeinated or carbonated drinks until 48 hours␣
↪after all symptoms have gone away. "],
        "context_set": ""
       },

       {"tag": "Bruises",
```

```
        "patterns": ["How do you treat Bruises?", "what to do if i get a␣
↪Bruise?", "Which medicine to take if I get a Bruise?", "How to cure Bruises?
↪"],
        "responses": ["1)Ice the bruise with an ice pack wrapped in a towel.␣
↪2)Leave it in place for 10 to 20 minutes. 3)Repeat several times a day for a␣
↪day or two as needed. 4)Compress the bruised area if it is swelling, using␣
↪an elastic bandage. "],
        "context_set": ""
       },

       {"tag": "Broken Toe",
        "patterns": ["How do you treat a Broken Toe?", "what to do if i get a␣
↪Broken Toe?", "Which medicine to take if I get a Broken Toe?", "How to cure␣
↪Broken Toe?"],
        "responses": ["1)To help decrease pain and swelling in a broken toe,␣
↪elevate the foot, ice the injury, and stay off the foot. 2)Depending on the␣
↪severity of the fracture, the toe may need to be put back into place␣
↪(reduced), and some compound toe fractures may require surgery.3) Most␣
↪broken toes heal without complications in six weeks."],
        "context_set": ""
       },

       {"tag": "Choking",
        "patterns": ["How do you treat Choking?", "what to do if i get a Choke?
↪", "Which medicine to take if I get Choked?", "How to cure Choking?"],
        "responses": ["1)Encourage them to keep coughing to try to clear the␣
↪blockage. 2)Ask them to try to spit out the object if it's in their mouth.␣
↪3)If coughing doesn't work, start back blows and Abdonominal thrusts"],
        "context_set": ""
       },

       {"tag": "Wound",
        "patterns": ["How do you treat a wound?", "what to do if i get a Wound?
↪", "Which medicine to take if I get wounded?", "How to cure a wound?"],
        "responses": ["1)Rinse the cut or wound with water and apply pressure␣
↪with sterile gauze, a bandage, or a clean cloth. 2)If blood soaks through␣
↪the bandage, place another bandage on top of the first and keep applying␣
↪pressure. 3)Raise the injured body part to slow bleeding. 4)When bleeding␣
↪stops, cover the wound with a new, clean bandage."],
        "context_set": ""
       },

       {"tag": "Diarrhea",
        "patterns": ["How do you treat Diarrhea?", "what to do if i get␣
↪Diarrhea?", "Which medicine to take if I get Diarrhea?", "How to cure␣
↪Diarrhea?"],
```

```
        "responses": ["1)Hydrating the body is essential for recovering from␣
↪diarrhea.This causes the body to lose electrolytes such as sodium and␣
↪chloride. 2)It is highly recommended to avoid dairy products, as they may␣
↪worsen diarrhea in some people. 3)However, if diarrhea lasts for more than 2␣
↪days, seek medical advice to avoid complications."],
        "context_set": ""
       },

       {"tag": "Frost bite",
        "patterns": ["How do you treat a Frost bite?", "what to do if i get a␣
↪Frost bite?", "Which medicine to take if I get a Frost bite?", "How to cure␣
↪Frost bite?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Heat Exhaustion",
        "patterns": ["How do you treat Heat Exhaustion?", "what to do if i␣
↪feel Exhausted due to heat?", "Which medicine to take if I get Exhausted?",␣
↪"How to cure Heat Exhaustion?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Heat Stroke",
        "patterns": ["How do you treat Heat Stroke?", "what to do if i get a␣
↪Heat Stroke?", "Which medicine to take if I get Stroke?", "How to cure a␣
↪Heat Stroke?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Insect Bites",
        "patterns": ["How do you treat a Insect Bite?", "what to do if a␣
↪insect bites me?", "Which medicine to take if I get bitten by a insect?",␣
↪"How to cure insect bite?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "nose bleed",
        "patterns": ["How do you treat a bleeding nose?", "what to do if i my␣
↪nose is bleeding?", "Which medicine to take if I get nose bleed?", "How to␣
↪cure nose bleeding?"],
        "responses": [" "],
        "context_set": ""
```

```
      },

      {"tag": "Pulled Muscle",
       "patterns": ["How do you treat a Pulled Muscle?", "what to do if my␣
↪muscle is pulled?", "Which medicine to take if I got pulled muscle?", "How␣
↪to cure a pulled muscle?"],
       "responses": [" "],
       "context_set": ""
      },

      {"tag": "Rectal bleeding",
       "patterns": ["How do you treat Rectal Bleeding?", "what to do if i get␣
↪a Rectal Bleeding?", "Which medicine to take if I get Rectal Bleeding?",␣
↪"How to cure Rectal Bleeding?"],
       "responses": [" "],
       "context_set": ""
      },

      {"tag": "Sun Burn",
       "patterns": ["How do you treat Sun Burn?", "what to do if i get a Sun␣
↪Burn?", "Which medicine to take if I get Sun Burn?", "How to cure a Sun Burn?
↪"],
       "responses": [" "],
       "context_set": ""
      },

      {"tag": "Testicle Pain",
       "patterns": ["How do you treat Testicle Pain?", "what to do if i get a␣
↪Testicle Pain?", "Which medicine to take if I get a Testicle Pain?", "How to␣
↪cure Testicle Pain?"],
       "responses": [" "],
       "context_set": ""
      },

      {"tag": "Vertigo",
       "patterns": ["How do you treat a Vertigo?", "what to do if i get a␣
↪Vertigo?", "Which medicine to take if I get Vertigo?", "How to cure a␣
↪Vertigo?"],
       "responses": [" "],
       "context_set": ""
      },

      {"tag": "Normal Bleeding",
       "patterns": ["How do you treat bleeding?", "what to do if i get a␣
↪Bleeding?", "Which medicine to take if I get bleeding?", "How to cure␣
↪Bleeding?"],
```

```
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Eye Injury",
        "patterns": ["How do you treat an eye Injury?", "what to do if i get a␣
↪eye Injury?", "Which medicine to take if I injured my eye?", "How to cure␣
↪injured eye?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Chemical Burn",
        "patterns": ["How do you treat a chemical burn?", "what to do if i get␣
↪a Chemical Burn?", "Which medicine to take if I get burn due to chemicals?",␣
↪"How to cure Chemical Burn?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Poison",
        "patterns": ["How do you treat a Poison?", "what to do if i get Poison?
↪", "Which medicine to take if I am poisoned?", "How to cure Poisoning?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Teeth",
        "patterns": ["How do you treat broken Teeth ?", "what to do if my␣
↪Teeth got broken?", "Which medicine to take if I get broken teeth?", "cure␣
↪broken teeth?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "seizure",
        "patterns": ["How do you treat a seizure?", "what to do if i get a␣
↪seizure?", "Which medicine to take if I get seizure?", "How to cure seizure?
↪"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Head Injury",
        "patterns": ["How do you treat a head Injury?", "what to do if i get a␣
↪Head Injury?", "Which medicine to take if I get injured in the head?", "How␣
↪to cure Head Injury?"],
```

```
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Fainting",
        "patterns": ["How do you treat Faint?", "what to do if i feel like␣
↪Fainting?", "Which medicine to take if I get a Faint?", "How to cure␣
↪Fainting?"],
        "responses": [" "],
        "context_set": ""
       },

       {"tag": "Headache",
        "patterns": ["How do you treat a mild Headache?", "what to do if i get␣
↪a mild Headache?", "Which medicine to take if I have a mild headache?", "How␣
↪to cure a mild headache?"],
        "responses": ["Give ibuprofen (Advil, Motrin), aspirin, or␣
↪acetaminophen (Tylenol) for pain. Avoid ibuprofen and other NSAIDs if the␣
↪person has heart failure or kidney failure. Do not give aspirin to a child␣
↪under age 18."],
        "context_set": ""
       },

       {"tag": "Cold",
        "patterns": ["How do you treat a Cold?", "what to do if i get a mild␣
↪Cold?", "Which medicine to take if I have a Cold?", "How to cure Cold?"],
        "responses": ["1)Keeping hydrated is absolutely vital to help 'flush'␣
↪out the cold, as well as to break down congestion and keep your throat␣
↪lubricated. 2)Vitamin C is extremely helpful when fighting infection, so at␣
↪the first sign of a cold be sure to increase your intake by eating plenty of␣
↪berries, citrus fruits, papayas, broccoli and red peppers which will help␣
↪keep you protected. 3)When it comes to combating a cold,Vitamin D is␣
↪essential in helping to regulate immune response."],
        "context_set": ""
       },

       {"tag": "Rash",
        "patterns": ["How do you treat Rashes?", "what to do if i get a Rash?
↪", "Which medicine to take if I have a Rash?", "How to cure Rash?"],
        "responses": ["1)Olive oil helps in healing and promotes skin renewal␣
↪given it is packed with vitamin E and antioxidants. It also soothes the skin␣
↪and reduces itching. 2)Baking soda is useful in drying skin rashes as also␣
↪in relieving itching and inflammation. 3)Aloe Vera,Thanks to its␣
↪antibacterial, antifungal, anti-inflammatory and emollient properties, aloe␣
↪vera is excellent for treating a number of skin ailments including rashes as␣
↪also soothing the skin."],
```

```
        "context_set": ""
       },

       {"tag": "snake bite",
        "patterns": ["How do you treat a snake bite?", "what to do if i get a␣
↪snake bite?", "Which medicine to take if I get a snake bite?", "How to cure␣
↪snake bite?", "i got bit by a snake"],
        "responses": ["While waiting for medical help: 1)Move the person␣
↪beyond striking distance of the snake. 2)Have the person lie down with wound␣
↪below the heart. 3)Keep the person calm and at rest, remaining as still as␣
↪possible to keep venom from spreading. 4)Cover the wound with loose, sterile␣
↪bandage. 5)Remove any jewelry from the area that was bitten. 6)Remove shoes␣
↪if the leg or foot was bitten."],
        "context_set": ""
       },

       {"tag": "animal bite",
        "patterns": ["How do you treat a animal bite?", "How do you treat a␣
↪monkey bite?","How do you treat a dog bite?", "what to do if i get a animal␣
↪bite?", "Which medicine to take if I get a monekey bite?", "How to cure dog␣
↪bite?", "i got bit by a dog"],
        "responses": ["1)Wash the wound with soap and warm water. 2)Gently␣
↪press a clean cloth over the wound to stop the flow of blood. 3)Apply an␣
↪antibacterial ointment to the wound. 4)Cover with a sterile bandage. 5)Watch␣
↪for signs of infection. 6)Seek help if you suspect infection or possible␣
↪exposure to rabies, or if the wound is severe."],
        "context_set": ""
       },

       {"tag": "Drowning",
        "patterns": ["What to do if someone is Drowning?", "what to do if␣
↪someone drowned?", "What steps to take if i see a drowning person?", "How to␣
↪help a drowning person?"],
        "responses": ["1)Place your ear next to the person's mouth and nose.␣
↪Do you feel air on your cheek? 2)Look to see if the person's chest is moving.
↪If the Person is Not Breathing, Check Pulse. 3)Check the person's pulse for␣
↪10 seconds.If There is No Pulse, Start CPR."],
        "context_set": ""
       },

   {"tag": "CPR",
        "patterns": ["How to give CPR??", "what to do in a CPR?", "What steps␣
↪to take in a CPR??", "How to help a drowning person in CPR?"],
```

```
        "responses": ["1)For an adult or child, place the heel of one hand on␣
 ↪the center of the chest at the nipple line. You can also push with one hand␣
 ↪on top of the other. For an infant, place two fingers on the breastbone.␣
 ↪2)For an adult or child, press down at least 2 inches. Make sure not to␣
 ↪press on ribs. For an infant, press down about 1 and 1/2 inches. Make sure␣
 ↪not to press on the end of the breastbone. 3)Do chest compressions only, at␣
 ↪the rate of 100-120 per minute or more. Let the chest rise completely␣
 ↪between pushes. 4)Check to see if the person has started breathing."],
        "context_set": ""
       },

       {"tag": "Fracture",
        "patterns": ["How do you treat a Fracture?", "what to do if i get a␣
 ↪Fracture?", "Which medicine to take if I have a Fracture?", "How to cure a␣
 ↪Fracture?"],
        "responses": ["1)Stop any bleeding. Apply pressure to the wound with a␣
 ↪sterile bandage, a clean cloth or a clean piece of clothing. 2)Immobilize␣
 ↪the injured area. Don't try to realign the bone or push a bone that's␣
 ↪sticking out back in. If you've been trained in how to splint and␣
 ↪professional help isn't readily available, apply a splint to the area above␣
 ↪and below the fracture sites. Padding the splints can help reduce discomfort.
 ↪ 3)Apply ice packs to limit swelling and help relieve pain. Don't apply ice␣
 ↪directly to the skin. Wrap the ice in a towel, piece of cloth or some other␣
 ↪material. 4)Treat for shock. If the person feels faint or is breathing in␣
 ↪short, rapid breaths, lay the person down with the head slightly lower than␣
 ↪the trunk and, if possible, elevate the legs."],
        "context_set": ""
       }
   ]
}
with open("intents.json", "w") as file:
    json.dump(intents, file)
```

2 load the json file and extract the data.

[96]:
```
with open('intents.json') as file:
    data = json.load(file)

training_sentences = []
training_labels = []
labels = []
responses = []


for intent in data['intents']:
    for pattern in intent['patterns']:
```

```
        # get ach sentence
        training_sentences.append(pattern)
        #get each tag of each sentence
        training_labels.append(intent['tag'])
    # get all responses of a sentence
    responses.append(intent['responses'])

    if intent['tag'] not in labels:
        # get unique tags
        labels.append(intent['tag'])

num_classes = len(labels)
```

[112]:
```
training_sentences[:20]
```

[112]:
```
['Hi',
 'Hey',
 'Is anyone there?',
 'Hello',
 'Hay',
 'Bye',
 'See you later',
 'Goodbye',
 'Thanks',
 'Thank you',
 "That's helpful",
 'Thanks for the help',
 'Who are you?',
 'What are you?',
 'Who you are?',
 'what is your name',
 'what should I call you',
 'whats your name?',
 'Could you help me?',
 'give me a hand please']
```

[105]:
```
training_labels
```

[105]:
```
array([44, 44, 44, 44, 44, 43, 43, 43, 51, 51, 51, 51, 39, 39, 39, 46, 46,
       46, 45, 45, 45, 45, 45, 45, 45, 42, 42, 42, 42, 42, 41, 41, 41,  9,
        9,  9,  9,  9,  1,  1,  1,  1,  1,  1, 50, 50, 50, 50, 31, 31, 31,
       31, 32, 32, 32, 32, 33, 33, 33, 33, 33, 33, 14, 14, 14, 14, 23, 23,
       23, 23, 23, 23,  8,  8,  8,  8,  8, 30, 30, 30, 30, 17, 17, 17, 17,
       29, 29, 29, 29,  0,  0,  0,  0,  3,  3,  3,  3,  2,  2,  2,  2,  6,
        6,  6,  6, 38, 38, 38, 38, 10, 10, 10, 10, 16, 16, 16, 16, 20, 20,
       20, 20, 21, 21, 21, 21, 22, 22, 22, 22, 47, 47, 47, 47, 26, 26, 26,
       26, 28, 28, 28, 28, 34, 34, 34, 34, 36, 36, 36, 36, 37, 37, 37, 37,
```

```
       24, 24, 24, 24, 12, 12, 12, 12,  5,  5,  5,  5, 25, 25, 25, 25, 35,
       35, 35, 35, 48, 48, 48, 48, 18, 18, 18, 18, 13, 13, 13, 13, 19, 19,
       19, 19,  7,  7,  7,  7, 27, 27, 27, 27, 49, 49, 49, 49, 49, 40, 40,
       40, 40, 40, 40, 40, 11, 11, 11, 11,  4,  4,  4,  4, 15, 15, 15, 15])
```

[114]:
```
responses[:10]
```

[114]:
```
[['Hello', 'Hi', 'Hi there'],
 ['See you later', 'Have a nice day', 'Bye! Come back again'],
 ['Happy to help!', 'Any time!', 'My pleasure', "You're most welcome!"],
 ['I.m ammar_bot, your ammar_bot assistant',
  "I'm ammar_bot, an Artificial Intelligent bot"],
 ['You can call me ammar_bot.', "I'm ammar_bot!", 'Just call me as ammar_bot'],
 ['Tell me how can assist you',
  'Tell me your problem to assist you',
  'Yes Sure, How can I support you'],
 ['You can just easily create a new account from our web site',
  'Just go to our web site and follow the guidelines to create a new account'],
 ['Please provide us your complaint in order to assist you',
  'Please mention your complaint, we will reach you and sorry for any
inconvenience caused'],
 ['Wash the cut properly to prevent infection and stop the bleeding by applying
pressure for 1-2minutes until bleeding stops. Apply Petroleum Jelly to make sure
that the wound is moist for quick healing. Finally cover the cut with a sterile
bandage. Pain relievers such as acetaminophen can be applied.'],
 ['Begin with washed hands.Gently clean the area with cool to lukewarm water and
mild soap. Remove dirt or other particles from the wound using sterilized
tweezers.For a mild scrape that's not bleeding, leave the wound uncovered.If the
wound is bleeding, use a clean cloth or bandage, and apply gentle pressure to
the area to stop any bleeding.Cover a wound that bled with a thin layer of
topical antibiotic ointment, like Bacitracin, or a sterile moisture barrier
ointment, like Aquaphor. Cover it with a clean bandage or gauze. Gently clean
the wound and change the ointment and bandage once per day.Watch the area for
signs of infection, like pain or redness and swelling. See your doctor if you
suspect infection.']]
```

Then we use "LabelEncoder()" function provided by scikit-learn to convert the target labels into a model understandable form.

[97]:
```
lbl_encoder = LabelEncoder()
lbl_encoder.fit(training_labels)
training_labels = lbl_encoder.transform(training_labels)
```

[115]:
```
training_labels[:20]
```

[115]:
```
array([44, 44, 44, 44, 44, 43, 43, 43, 51, 51, 51, 51, 39, 39, 39, 46, 46,
       46, 45, 45])
```

we vectorize our text data corpus by using the "Tokenizer" class

[98]:
```
vocab_size = 1000
embedding_dim = 16
max_len = 20
oov_token = "<OOV>"

tokenizer = Tokenizer(num_words=vocab_size, oov_token=oov_token)
tokenizer.fit_on_texts(training_sentences)
word_index = tokenizer.word_index
sequences = tokenizer.texts_to_sequences(training_sentences)
padded_sequences = pad_sequences(sequences, truncating='post', maxlen=max_len)
```

[117]:
```
padded_sequences[:10]
```

[117]:
```
array([[  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0, 115],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0, 116],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,  24, 117,  88],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0, 118],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0, 119],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0, 120],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,  89,   9, 121],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0, 122],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0,   0,  90],
       [  0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,   0,
          0,   0,   0,   0,   0, 123,   9]])
```

`pad_sequences` transform all sentences to be equal in vetors

3 Model Training

Let's define our Neural Network architecture for the proposed model and for that we use the "Sequential" model class of Keras

[99]:
```
model = Sequential()
model.add(Embedding(vocab_size, embedding_dim, input_length=max_len))
model.add(GlobalAveragePooling1D())
model.add(Dense(16, activation='relu'))
model.add(Dense(16, activation='relu'))
model.add(Dense(num_classes, activation='softmax'))
```

```
model.compile(loss='sparse_categorical_crossentropy',
              optimizer='adam', metrics=['accuracy'])

model.summary()
```

```
Model: "sequential_5"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 embedding_5 (Embedding)     (None, 20, 16)            16000

 global_average_pooling1d_5   (None, 16)               0
 (GlobalAveragePooling1D)

 dense_15 (Dense)            (None, 16)                272

 dense_16 (Dense)            (None, 16)                272

 dense_17 (Dense)            (None, 52)                884

=================================================================
Total params: 17,428
Trainable params: 17,428
Non-trainable params: 0
_________________________________________________________________
```

fit the model with `padded_sequences` and `training_labels`

[100]:
```
epochs = 500
history = model.fit(padded_sequences, np.array(training_labels), epochs=epochs)
```

```
Epoch 1/500
7/7 [==============================] - 1s 5ms/step - loss: 3.9522 - accuracy:
0.0136
Epoch 2/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9510 - accuracy:
0.0271
Epoch 3/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9502 - accuracy:
0.0181
Epoch 4/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9495 - accuracy:
0.0226
Epoch 5/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9487 - accuracy:
0.0271
Epoch 6/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9480 - accuracy:
```

```
0.0407
Epoch 7/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9470 - accuracy:
0.0452
Epoch 8/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9463 - accuracy:
0.0498
Epoch 9/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9451 - accuracy:
0.0498
Epoch 10/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9439 - accuracy:
0.0362
Epoch 11/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9427 - accuracy:
0.0543
Epoch 12/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9413 - accuracy:
0.0452
Epoch 13/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9395 - accuracy:
0.0498
Epoch 14/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9375 - accuracy:
0.0543
Epoch 15/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9354 - accuracy:
0.0543
Epoch 16/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9329 - accuracy:
0.0498
Epoch 17/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9301 - accuracy:
0.0543
Epoch 18/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9266 - accuracy:
0.0588
Epoch 19/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9230 - accuracy:
0.0633
Epoch 20/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9186 - accuracy:
0.0588
Epoch 21/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9136 - accuracy:
0.0543
Epoch 22/500
7/7 [==============================] - 0s 6ms/step - loss: 3.9080 - accuracy:
```

```
0.0498
Epoch 23/500
7/7 [==============================] - 0s 5ms/step - loss: 3.9012 - accuracy:
0.0543
Epoch 24/500
7/7 [==============================] - 0s 5ms/step - loss: 3.8942 - accuracy:
0.0452
Epoch 25/500
7/7 [==============================] - 0s 6ms/step - loss: 3.8860 - accuracy:
0.0452
Epoch 26/500
7/7 [==============================] - 0s 6ms/step - loss: 3.8765 - accuracy:
0.0498
Epoch 27/500
7/7 [==============================] - 0s 5ms/step - loss: 3.8675 - accuracy:
0.0362
Epoch 28/500
7/7 [==============================] - 0s 6ms/step - loss: 3.8560 - accuracy:
0.0362
Epoch 29/500
7/7 [==============================] - 0s 5ms/step - loss: 3.8436 - accuracy:
0.0362
Epoch 30/500
7/7 [==============================] - 0s 5ms/step - loss: 3.8306 - accuracy:
0.0407
Epoch 31/500
7/7 [==============================] - 0s 5ms/step - loss: 3.8169 - accuracy:
0.0452
Epoch 32/500
7/7 [==============================] - 0s 5ms/step - loss: 3.8024 - accuracy:
0.0407
Epoch 33/500
7/7 [==============================] - 0s 5ms/step - loss: 3.7861 - accuracy:
0.0452
Epoch 34/500
7/7 [==============================] - 0s 6ms/step - loss: 3.7705 - accuracy:
0.0407
Epoch 35/500
7/7 [==============================] - 0s 5ms/step - loss: 3.7541 - accuracy:
0.0498
Epoch 36/500
7/7 [==============================] - 0s 6ms/step - loss: 3.7357 - accuracy:
0.0452
Epoch 37/500
7/7 [==============================] - 0s 5ms/step - loss: 3.7183 - accuracy:
0.0407
Epoch 38/500
7/7 [==============================] - 0s 5ms/step - loss: 3.6999 - accuracy:
```

```
0.0498
Epoch 39/500
7/7 [==============================] - 0s 5ms/step - loss: 3.6823 - accuracy:
0.0407
Epoch 40/500
7/7 [==============================] - 0s 5ms/step - loss: 3.6630 - accuracy:
0.0452
Epoch 41/500
7/7 [==============================] - 0s 5ms/step - loss: 3.6440 - accuracy:
0.0407
Epoch 42/500
7/7 [==============================] - 0s 5ms/step - loss: 3.6242 - accuracy:
0.0543
Epoch 43/500
7/7 [==============================] - 0s 7ms/step - loss: 3.6027 - accuracy:
0.0588
Epoch 44/500
7/7 [==============================] - 0s 6ms/step - loss: 3.5833 - accuracy:
0.0543
Epoch 45/500
7/7 [==============================] - 0s 6ms/step - loss: 3.5602 - accuracy:
0.0724
Epoch 46/500
7/7 [==============================] - 0s 6ms/step - loss: 3.5365 - accuracy:
0.0633
Epoch 47/500
7/7 [==============================] - 0s 6ms/step - loss: 3.5125 - accuracy:
0.0679
Epoch 48/500
7/7 [==============================] - 0s 5ms/step - loss: 3.4881 - accuracy:
0.0724
Epoch 49/500
7/7 [==============================] - 0s 6ms/step - loss: 3.4633 - accuracy:
0.0769
Epoch 50/500
7/7 [==============================] - 0s 9ms/step - loss: 3.4391 - accuracy:
0.0860
Epoch 51/500
7/7 [==============================] - 0s 5ms/step - loss: 3.4110 - accuracy:
0.0905
Epoch 52/500
7/7 [==============================] - 0s 6ms/step - loss: 3.3846 - accuracy:
0.0950
Epoch 53/500
7/7 [==============================] - 0s 6ms/step - loss: 3.3564 - accuracy:
0.1041
Epoch 54/500
7/7 [==============================] - 0s 7ms/step - loss: 3.3263 - accuracy:
```

```
0.1041
Epoch 55/500
7/7 [==============================] - 0s 6ms/step - loss: 3.2966 - accuracy:
0.1041
Epoch 56/500
7/7 [==============================] - 0s 5ms/step - loss: 3.2667 - accuracy:
0.1086
Epoch 57/500
7/7 [==============================] - 0s 6ms/step - loss: 3.2354 - accuracy:
0.1222
Epoch 58/500
7/7 [==============================] - 0s 6ms/step - loss: 3.2042 - accuracy:
0.1222
Epoch 59/500
7/7 [==============================] - 0s 6ms/step - loss: 3.1740 - accuracy:
0.1222
Epoch 60/500
7/7 [==============================] - 0s 6ms/step - loss: 3.1424 - accuracy:
0.1312
Epoch 61/500
7/7 [==============================] - 0s 5ms/step - loss: 3.1094 - accuracy:
0.1403
Epoch 62/500
7/7 [==============================] - 0s 5ms/step - loss: 3.0771 - accuracy:
0.1312
Epoch 63/500
7/7 [==============================] - 0s 5ms/step - loss: 3.0456 - accuracy:
0.1357
Epoch 64/500
7/7 [==============================] - 0s 6ms/step - loss: 3.0117 - accuracy:
0.1674
Epoch 65/500
7/7 [==============================] - 0s 6ms/step - loss: 2.9776 - accuracy:
0.1810
Epoch 66/500
7/7 [==============================] - 0s 6ms/step - loss: 2.9462 - accuracy:
0.1900
Epoch 67/500
7/7 [==============================] - 0s 6ms/step - loss: 2.9106 - accuracy:
0.1946
Epoch 68/500
7/7 [==============================] - 0s 6ms/step - loss: 2.8775 - accuracy:
0.1946
Epoch 69/500
7/7 [==============================] - 0s 6ms/step - loss: 2.8431 - accuracy:
0.2127
Epoch 70/500
7/7 [==============================] - 0s 5ms/step - loss: 2.8098 - accuracy:
```

```
0.1946
Epoch 71/500
7/7 [==============================] - 0s 6ms/step - loss: 2.7748 - accuracy:
0.1991
Epoch 72/500
7/7 [==============================] - 0s 6ms/step - loss: 2.7404 - accuracy:
0.2217
Epoch 73/500
7/7 [==============================] - 0s 6ms/step - loss: 2.7104 - accuracy:
0.2308
Epoch 74/500
7/7 [==============================] - 0s 6ms/step - loss: 2.6760 - accuracy:
0.2308
Epoch 75/500
7/7 [==============================] - 0s 6ms/step - loss: 2.6413 - accuracy:
0.2443
Epoch 76/500
7/7 [==============================] - 0s 6ms/step - loss: 2.6066 - accuracy:
0.2624
Epoch 77/500
7/7 [==============================] - 0s 6ms/step - loss: 2.5729 - accuracy:
0.2624
Epoch 78/500
7/7 [==============================] - 0s 6ms/step - loss: 2.5393 - accuracy:
0.2760
Epoch 79/500
7/7 [==============================] - 0s 6ms/step - loss: 2.5080 - accuracy:
0.2760
Epoch 80/500
7/7 [==============================] - 0s 6ms/step - loss: 2.4736 - accuracy:
0.2896
Epoch 81/500
7/7 [==============================] - 0s 5ms/step - loss: 2.4406 - accuracy:
0.2986
Epoch 82/500
7/7 [==============================] - 0s 6ms/step - loss: 2.4100 - accuracy:
0.3077
Epoch 83/500
7/7 [==============================] - 0s 5ms/step - loss: 2.3741 - accuracy:
0.3258
Epoch 84/500
7/7 [==============================] - 0s 6ms/step - loss: 2.3422 - accuracy:
0.3484
Epoch 85/500
7/7 [==============================] - 0s 6ms/step - loss: 2.3086 - accuracy:
0.3575
Epoch 86/500
7/7 [==============================] - 0s 5ms/step - loss: 2.2751 - accuracy:
```

```
0.3756
Epoch 87/500
7/7 [==============================] - 0s 6ms/step - loss: 2.2458 - accuracy:
0.3801
Epoch 88/500
7/7 [==============================] - 0s 5ms/step - loss: 2.2129 - accuracy:
0.3937
Epoch 89/500
7/7 [==============================] - 0s 5ms/step - loss: 2.1826 - accuracy:
0.4118
Epoch 90/500
7/7 [==============================] - 0s 5ms/step - loss: 2.1497 - accuracy:
0.4118
Epoch 91/500
7/7 [==============================] - 0s 6ms/step - loss: 2.1172 - accuracy:
0.4525
Epoch 92/500
7/7 [==============================] - 0s 5ms/step - loss: 2.0895 - accuracy:
0.4842
Epoch 93/500
7/7 [==============================] - 0s 6ms/step - loss: 2.0583 - accuracy:
0.5023
Epoch 94/500
7/7 [==============================] - 0s 6ms/step - loss: 2.0254 - accuracy:
0.5294
Epoch 95/500
7/7 [==============================] - 0s 6ms/step - loss: 1.9985 - accuracy:
0.5204
Epoch 96/500
7/7 [==============================] - 0s 6ms/step - loss: 1.9675 - accuracy:
0.5204
Epoch 97/500
7/7 [==============================] - 0s 6ms/step - loss: 1.9348 - accuracy:
0.5430
Epoch 98/500
7/7 [==============================] - 0s 5ms/step - loss: 1.9069 - accuracy:
0.5385
Epoch 99/500
7/7 [==============================] - 0s 6ms/step - loss: 1.8760 - accuracy:
0.5701
Epoch 100/500
7/7 [==============================] - 0s 6ms/step - loss: 1.8468 - accuracy:
0.6018
Epoch 101/500
7/7 [==============================] - 0s 6ms/step - loss: 1.8169 - accuracy:
0.6154
Epoch 102/500
7/7 [==============================] - 0s 5ms/step - loss: 1.7898 - accuracy:
```

```
0.6018
Epoch 103/500
7/7 [==============================] - 0s 5ms/step - loss: 1.7615 - accuracy:
0.6244
Epoch 104/500
7/7 [==============================] - 0s 6ms/step - loss: 1.7347 - accuracy:
0.6063
Epoch 105/500
7/7 [==============================] - 0s 6ms/step - loss: 1.7094 - accuracy:
0.6652
Epoch 106/500
7/7 [==============================] - 0s 6ms/step - loss: 1.6783 - accuracy:
0.6787
Epoch 107/500
7/7 [==============================] - 0s 5ms/step - loss: 1.6534 - accuracy:
0.7014
Epoch 108/500
7/7 [==============================] - 0s 5ms/step - loss: 1.6267 - accuracy:
0.7240
Epoch 109/500
7/7 [==============================] - 0s 7ms/step - loss: 1.6034 - accuracy:
0.6833
Epoch 110/500
7/7 [==============================] - 0s 6ms/step - loss: 1.5783 - accuracy:
0.7195
Epoch 111/500
7/7 [==============================] - 0s 5ms/step - loss: 1.5545 - accuracy:
0.7285
Epoch 112/500
7/7 [==============================] - 0s 5ms/step - loss: 1.5316 - accuracy:
0.7421
Epoch 113/500
7/7 [==============================] - 0s 5ms/step - loss: 1.5040 - accuracy:
0.7557
Epoch 114/500
7/7 [==============================] - 0s 5ms/step - loss: 1.4811 - accuracy:
0.7330
Epoch 115/500
7/7 [==============================] - 0s 4ms/step - loss: 1.4569 - accuracy:
0.7376
Epoch 116/500
7/7 [==============================] - 0s 5ms/step - loss: 1.4347 - accuracy:
0.7828
Epoch 117/500
7/7 [==============================] - 0s 5ms/step - loss: 1.4123 - accuracy:
0.7873
Epoch 118/500
7/7 [==============================] - 0s 5ms/step - loss: 1.3965 - accuracy:
```

```
0.7919
Epoch 119/500
7/7 [==============================] - 0s 5ms/step - loss: 1.3696 - accuracy:
0.7873
Epoch 120/500
7/7 [==============================] - 0s 5ms/step - loss: 1.3479 - accuracy:
0.7783
Epoch 121/500
7/7 [==============================] - 0s 5ms/step - loss: 1.3252 - accuracy:
0.7964
Epoch 122/500
7/7 [==============================] - 0s 6ms/step - loss: 1.3062 - accuracy:
0.8009
Epoch 123/500
7/7 [==============================] - 0s 5ms/step - loss: 1.2870 - accuracy:
0.8100
Epoch 124/500
7/7 [==============================] - 0s 5ms/step - loss: 1.2668 - accuracy:
0.8281
Epoch 125/500
7/7 [==============================] - 0s 4ms/step - loss: 1.2453 - accuracy:
0.8326
Epoch 126/500
7/7 [==============================] - 0s 6ms/step - loss: 1.2269 - accuracy:
0.8281
Epoch 127/500
7/7 [==============================] - 0s 5ms/step - loss: 1.2083 - accuracy:
0.8371
Epoch 128/500
7/7 [==============================] - 0s 5ms/step - loss: 1.1872 - accuracy:
0.8552
Epoch 129/500
7/7 [==============================] - 0s 5ms/step - loss: 1.1689 - accuracy:
0.8597
Epoch 130/500
7/7 [==============================] - 0s 5ms/step - loss: 1.1514 - accuracy:
0.8371
Epoch 131/500
7/7 [==============================] - 0s 6ms/step - loss: 1.1336 - accuracy:
0.8416
Epoch 132/500
7/7 [==============================] - 0s 6ms/step - loss: 1.1165 - accuracy:
0.8552
Epoch 133/500
7/7 [==============================] - 0s 5ms/step - loss: 1.1023 - accuracy:
0.8688
Epoch 134/500
7/7 [==============================] - 0s 5ms/step - loss: 1.0819 - accuracy:
```

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0.8824
Epoch 135/500
7/7 [==============================] - 0s 6ms/step - loss: 1.0650 - accuracy:
0.8824
Epoch 136/500
7/7 [==============================] - 0s 6ms/step - loss: 1.0524 - accuracy:
0.8869
Epoch 137/500
7/7 [==============================] - 0s 6ms/step - loss: 1.0350 - accuracy:
0.8733
Epoch 138/500
7/7 [==============================] - 0s 6ms/step - loss: 1.0202 - accuracy:
0.8778
Epoch 139/500
7/7 [==============================] - 0s 6ms/step - loss: 1.0017 - accuracy:
0.8914
Epoch 140/500
7/7 [==============================] - 0s 5ms/step - loss: 0.9840 - accuracy:
0.8959
Epoch 141/500
7/7 [==============================] - 0s 6ms/step - loss: 0.9713 - accuracy:
0.9005
Epoch 142/500
7/7 [==============================] - 0s 5ms/step - loss: 0.9563 - accuracy:
0.9095
Epoch 143/500
7/7 [==============================] - 0s 5ms/step - loss: 0.9429 - accuracy:
0.8959
Epoch 144/500
7/7 [==============================] - 0s 6ms/step - loss: 0.9285 - accuracy:
0.9276
Epoch 145/500
7/7 [==============================] - 0s 6ms/step - loss: 0.9145 - accuracy:
0.9095
Epoch 146/500
7/7 [==============================] - 0s 5ms/step - loss: 0.9007 - accuracy:
0.9050
Epoch 147/500
7/7 [==============================] - 0s 5ms/step - loss: 0.8864 - accuracy:
0.9231
Epoch 148/500
7/7 [==============================] - 0s 5ms/step - loss: 0.8735 - accuracy:
0.9412
Epoch 149/500
7/7 [==============================] - 0s 5ms/step - loss: 0.8594 - accuracy:
0.9457
Epoch 150/500
7/7 [==============================] - 0s 6ms/step - loss: 0.8499 - accuracy:
```

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0.9186
Epoch 151/500
7/7 [==============================] - 0s 6ms/step - loss: 0.8368 - accuracy:
0.9231
Epoch 152/500
7/7 [==============================] - 0s 6ms/step - loss: 0.8215 - accuracy:
0.9367
Epoch 153/500
7/7 [==============================] - 0s 5ms/step - loss: 0.8097 - accuracy:
0.9367
Epoch 154/500
7/7 [==============================] - 0s 5ms/step - loss: 0.7992 - accuracy:
0.9367
Epoch 155/500
7/7 [==============================] - 0s 6ms/step - loss: 0.7858 - accuracy:
0.9321
Epoch 156/500
7/7 [==============================] - 0s 5ms/step - loss: 0.7779 - accuracy:
0.9321
Epoch 157/500
7/7 [==============================] - 0s 8ms/step - loss: 0.7680 - accuracy:
0.9548
Epoch 158/500
7/7 [==============================] - 0s 6ms/step - loss: 0.7534 - accuracy:
0.9593
Epoch 159/500
7/7 [==============================] - 0s 5ms/step - loss: 0.7410 - accuracy:
0.9457
Epoch 160/500
7/7 [==============================] - 0s 5ms/step - loss: 0.7336 - accuracy:
0.9593
Epoch 161/500
7/7 [==============================] - 0s 5ms/step - loss: 0.7217 - accuracy:
0.9367
Epoch 162/500
7/7 [==============================] - 0s 5ms/step - loss: 0.7111 - accuracy:
0.9367
Epoch 163/500
7/7 [==============================] - 0s 4ms/step - loss: 0.6987 - accuracy:
0.9367
Epoch 164/500
7/7 [==============================] - 0s 5ms/step - loss: 0.6904 - accuracy:
0.9412
Epoch 165/500
7/7 [==============================] - 0s 5ms/step - loss: 0.6806 - accuracy:
0.9638
Epoch 166/500
7/7 [==============================] - 0s 4ms/step - loss: 0.6730 - accuracy:
```

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0.9502
Epoch 167/500
7/7 [==============================] - 0s 4ms/step - loss: 0.6628 - accuracy:
0.9502
Epoch 168/500
7/7 [==============================] - 0s 4ms/step - loss: 0.6516 - accuracy:
0.9548
Epoch 169/500
7/7 [==============================] - 0s 6ms/step - loss: 0.6434 - accuracy:
0.9548
Epoch 170/500
7/7 [==============================] - 0s 5ms/step - loss: 0.6347 - accuracy:
0.9412
Epoch 171/500
7/7 [==============================] - 0s 5ms/step - loss: 0.6244 - accuracy:
0.9502
Epoch 172/500
7/7 [==============================] - 0s 4ms/step - loss: 0.6160 - accuracy:
0.9548
Epoch 173/500
7/7 [==============================] - 0s 4ms/step - loss: 0.6078 - accuracy:
0.9367
Epoch 174/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5971 - accuracy:
0.9729
Epoch 175/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5926 - accuracy:
0.9774
Epoch 176/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5823 - accuracy:
0.9683
Epoch 177/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5735 - accuracy:
0.9638
Epoch 178/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5652 - accuracy:
0.9593
Epoch 179/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5587 - accuracy:
0.9819
Epoch 180/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5503 - accuracy:
0.9729
Epoch 181/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5405 - accuracy:
0.9819
Epoch 182/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5338 - accuracy:
```

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0.9774
Epoch 183/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5251 - accuracy:
0.9819
Epoch 184/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5187 - accuracy:
0.9819
Epoch 185/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5116 - accuracy:
0.9819
Epoch 186/500
7/7 [==============================] - 0s 4ms/step - loss: 0.5052 - accuracy:
0.9774
Epoch 187/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4982 - accuracy:
0.9819
Epoch 188/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4908 - accuracy:
0.9819
Epoch 189/500
7/7 [==============================] - 0s 5ms/step - loss: 0.4861 - accuracy:
0.9774
Epoch 190/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4797 - accuracy:
0.9819
Epoch 191/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4718 - accuracy:
0.9819
Epoch 192/500
7/7 [==============================] - 0s 5ms/step - loss: 0.4660 - accuracy:
0.9774
Epoch 193/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4587 - accuracy:
0.9910
Epoch 194/500
7/7 [==============================] - 0s 5ms/step - loss: 0.4536 - accuracy:
0.9864
Epoch 195/500
7/7 [==============================] - 0s 5ms/step - loss: 0.4439 - accuracy:
0.9864
Epoch 196/500
7/7 [==============================] - 0s 5ms/step - loss: 0.4383 - accuracy:
0.9864
Epoch 197/500
7/7 [==============================] - 0s 5ms/step - loss: 0.4342 - accuracy:
0.9774
Epoch 198/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4279 - accuracy:
```

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0.9910
Epoch 199/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4211 - accuracy:
0.9819
Epoch 200/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4150 - accuracy:
0.9819
Epoch 201/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4093 - accuracy:
0.9910
Epoch 202/500
7/7 [==============================] - 0s 4ms/step - loss: 0.4040 - accuracy:
0.9864
Epoch 203/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3978 - accuracy:
0.9864
Epoch 204/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3906 - accuracy:
0.9910
Epoch 205/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3874 - accuracy:
0.9910
Epoch 206/500
7/7 [==============================] - 0s 5ms/step - loss: 0.3801 - accuracy:
0.9864
Epoch 207/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3762 - accuracy:
0.9910
Epoch 208/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3711 - accuracy:
0.9864
Epoch 209/500
7/7 [==============================] - 0s 5ms/step - loss: 0.3656 - accuracy:
0.9910
Epoch 210/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3605 - accuracy:
0.9910
Epoch 211/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3541 - accuracy:
0.9955
Epoch 212/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3506 - accuracy:
0.9864
Epoch 213/500
7/7 [==============================] - 0s 5ms/step - loss: 0.3454 - accuracy:
0.9864
Epoch 214/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3415 - accuracy:
```

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0.9864
Epoch 215/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3360 - accuracy:
0.9864
Epoch 216/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3306 - accuracy:
0.9910
Epoch 217/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3279 - accuracy:
0.9910
Epoch 218/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3220 - accuracy:
0.9955
Epoch 219/500
7/7 [==============================] - 0s 5ms/step - loss: 0.3175 - accuracy:
0.9955
Epoch 220/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3130 - accuracy:
0.9955
Epoch 221/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3090 - accuracy:
0.9910
Epoch 222/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3054 - accuracy:
0.9864
Epoch 223/500
7/7 [==============================] - 0s 4ms/step - loss: 0.3001 - accuracy:
0.9910
Epoch 224/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2951 - accuracy:
0.9864
Epoch 225/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2921 - accuracy:
0.9955
Epoch 226/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2876 - accuracy:
0.9955
Epoch 227/500
7/7 [==============================] - 0s 11ms/step - loss: 0.2826 - accuracy:
0.9955
Epoch 228/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2781 - accuracy:
0.9955
Epoch 229/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2743 - accuracy:
0.9955
Epoch 230/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2700 - accuracy:
```

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0.9955
Epoch 231/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2668 - accuracy:
0.9910
Epoch 232/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2635 - accuracy:
0.9910
Epoch 233/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2615 - accuracy:
0.9955
Epoch 234/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2589 - accuracy:
0.9955
Epoch 235/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2521 - accuracy:
0.9955
Epoch 236/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2495 - accuracy:
0.9955
Epoch 237/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2440 - accuracy:
0.9955
Epoch 238/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2423 - accuracy:
0.9910
Epoch 239/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2379 - accuracy:
0.9910
Epoch 240/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2336 - accuracy:
0.9955
Epoch 241/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2313 - accuracy:
0.9910
Epoch 242/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2281 - accuracy:
0.9910
Epoch 243/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2242 - accuracy:
0.9955
Epoch 244/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2212 - accuracy:
0.9955
Epoch 245/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2187 - accuracy:
0.9955
Epoch 246/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2152 - accuracy:
```

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0.9955
Epoch 247/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2118 - accuracy:
0.9955
Epoch 248/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2094 - accuracy:
0.9910
Epoch 249/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2062 - accuracy:
0.9955
Epoch 250/500
7/7 [==============================] - 0s 5ms/step - loss: 0.2036 - accuracy:
0.9955
Epoch 251/500
7/7 [==============================] - 0s 4ms/step - loss: 0.2008 - accuracy:
0.9955
Epoch 252/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1980 - accuracy:
0.9955
Epoch 253/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1947 - accuracy:
0.9955
Epoch 254/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1918 - accuracy:
0.9955
Epoch 255/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1887 - accuracy:
0.9955
Epoch 256/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1863 - accuracy:
0.9955
Epoch 257/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1835 - accuracy:
0.9955
Epoch 258/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1822 - accuracy:
0.9955
Epoch 259/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1781 - accuracy:
0.9955
Epoch 260/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1753 - accuracy:
0.9955
Epoch 261/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1734 - accuracy:
0.9955
Epoch 262/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1709 - accuracy:
```

```
0.9955
Epoch 263/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1690 - accuracy:
0.9955
Epoch 264/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1663 - accuracy:
0.9955
Epoch 265/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1638 - accuracy:
0.9955
Epoch 266/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1614 - accuracy:
0.9955
Epoch 267/500
7/7 [==============================] - 0s 6ms/step - loss: 0.1592 - accuracy:
0.9955
Epoch 268/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1569 - accuracy:
0.9955
Epoch 269/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1547 - accuracy:
1.0000
Epoch 270/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1537 - accuracy:
1.0000
Epoch 271/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1501 - accuracy:
1.0000
Epoch 272/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1481 - accuracy:
1.0000
Epoch 273/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1463 - accuracy:
0.9955
Epoch 274/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1439 - accuracy:
0.9955
Epoch 275/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1425 - accuracy:
1.0000
Epoch 276/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1403 - accuracy:
1.0000
Epoch 277/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1386 - accuracy:
1.0000
Epoch 278/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1381 - accuracy:
```

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1.0000
Epoch 279/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1344 - accuracy:
1.0000
Epoch 280/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1331 - accuracy:
1.0000
Epoch 281/500
7/7 [==============================] - 0s 7ms/step - loss: 0.1313 - accuracy:
1.0000
Epoch 282/500
7/7 [==============================] - 0s 7ms/step - loss: 0.1285 - accuracy:
1.0000
Epoch 283/500
7/7 [==============================] - 0s 6ms/step - loss: 0.1268 - accuracy:
1.0000
Epoch 284/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1253 - accuracy:
1.0000
Epoch 285/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1234 - accuracy:
1.0000
Epoch 286/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1217 - accuracy:
1.0000
Epoch 287/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1198 - accuracy:
1.0000
Epoch 288/500
7/7 [==============================] - 0s 9ms/step - loss: 0.1186 - accuracy:
1.0000
Epoch 289/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1166 - accuracy:
1.0000
Epoch 290/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1152 - accuracy:
1.0000
Epoch 291/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1132 - accuracy:
1.0000
Epoch 292/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1123 - accuracy:
1.0000
Epoch 293/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1109 - accuracy:
1.0000
Epoch 294/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1088 - accuracy:
```

```
1.0000
Epoch 295/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1075 - accuracy:
1.0000
Epoch 296/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1059 - accuracy:
1.0000
Epoch 297/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1045 - accuracy:
1.0000
Epoch 298/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1030 - accuracy:
1.0000
Epoch 299/500
7/7 [==============================] - 0s 4ms/step - loss: 0.1020 - accuracy:
1.0000
Epoch 300/500
7/7 [==============================] - 0s 5ms/step - loss: 0.1004 - accuracy:
1.0000
Epoch 301/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0992 - accuracy:
1.0000
Epoch 302/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0977 - accuracy:
1.0000
Epoch 303/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0963 - accuracy:
1.0000
Epoch 304/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0956 - accuracy:
1.0000
Epoch 305/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0935 - accuracy:
1.0000
Epoch 306/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0933 - accuracy:
1.0000
Epoch 307/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0913 - accuracy:
1.0000
Epoch 308/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0904 - accuracy:
1.0000
Epoch 309/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0890 - accuracy:
1.0000
Epoch 310/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0878 - accuracy:
```

```
1.0000
Epoch 311/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0862 - accuracy:
1.0000
Epoch 312/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0853 - accuracy:
1.0000
Epoch 313/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0846 - accuracy:
1.0000
Epoch 314/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0832 - accuracy:
1.0000
Epoch 315/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0821 - accuracy:
1.0000
Epoch 316/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0809 - accuracy:
1.0000
Epoch 317/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0798 - accuracy:
1.0000
Epoch 318/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0790 - accuracy:
1.0000
Epoch 319/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0778 - accuracy:
1.0000
Epoch 320/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0767 - accuracy:
1.0000
Epoch 321/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0759 - accuracy:
1.0000
Epoch 322/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0749 - accuracy:
1.0000
Epoch 323/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0739 - accuracy:
1.0000
Epoch 324/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0731 - accuracy:
1.0000
Epoch 325/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0726 - accuracy:
1.0000
Epoch 326/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0708 - accuracy:
```

```
1.0000
Epoch 327/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0704 - accuracy:
1.0000
Epoch 328/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0697 - accuracy:
1.0000
Epoch 329/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0684 - accuracy:
1.0000
Epoch 330/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0678 - accuracy:
1.0000
Epoch 331/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0666 - accuracy:
1.0000
Epoch 332/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0659 - accuracy:
1.0000
Epoch 333/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0653 - accuracy:
1.0000
Epoch 334/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0641 - accuracy:
1.0000
Epoch 335/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0636 - accuracy:
1.0000
Epoch 336/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0625 - accuracy:
1.0000
Epoch 337/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0617 - accuracy:
1.0000
Epoch 338/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0613 - accuracy:
1.0000
Epoch 339/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0603 - accuracy:
1.0000
Epoch 340/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0596 - accuracy:
1.0000
Epoch 341/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0587 - accuracy:
1.0000
Epoch 342/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0582 - accuracy:
```

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1.0000
Epoch 343/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0574 - accuracy:
1.0000
Epoch 344/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0568 - accuracy:
1.0000
Epoch 345/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0560 - accuracy:
1.0000
Epoch 346/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0551 - accuracy:
1.0000
Epoch 347/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0546 - accuracy:
1.0000
Epoch 348/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0540 - accuracy:
1.0000
Epoch 349/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0534 - accuracy:
1.0000
Epoch 350/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0527 - accuracy:
1.0000
Epoch 351/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0521 - accuracy:
1.0000
Epoch 352/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0517 - accuracy:
1.0000
Epoch 353/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0510 - accuracy:
1.0000
Epoch 354/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0504 - accuracy:
1.0000
Epoch 355/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0497 - accuracy:
1.0000
Epoch 356/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0491 - accuracy:
1.0000
Epoch 357/500
7/7 [==============================] - 0s 7ms/step - loss: 0.0484 - accuracy:
1.0000
Epoch 358/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0479 - accuracy:
```

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1.0000
Epoch 359/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0475 - accuracy:
1.0000
Epoch 360/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0469 - accuracy:
1.0000
Epoch 361/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0465 - accuracy:
1.0000
Epoch 362/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0458 - accuracy:
1.0000
Epoch 363/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0451 - accuracy:
1.0000
Epoch 364/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0450 - accuracy:
1.0000
Epoch 365/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0443 - accuracy:
1.0000
Epoch 366/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0437 - accuracy:
1.0000
Epoch 367/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0432 - accuracy:
1.0000
Epoch 368/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0430 - accuracy:
1.0000
Epoch 369/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0422 - accuracy:
1.0000
Epoch 370/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0419 - accuracy:
1.0000
Epoch 371/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0416 - accuracy:
1.0000
Epoch 372/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0410 - accuracy:
1.0000
Epoch 373/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0404 - accuracy:
1.0000
Epoch 374/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0398 - accuracy:
```

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1.0000
Epoch 375/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0395 - accuracy:
1.0000
Epoch 376/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0390 - accuracy:
1.0000
Epoch 377/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0385 - accuracy:
1.0000
Epoch 378/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0382 - accuracy:
1.0000
Epoch 379/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0377 - accuracy:
1.0000
Epoch 380/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0373 - accuracy:
1.0000
Epoch 381/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0369 - accuracy:
1.0000
Epoch 382/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0365 - accuracy:
1.0000
Epoch 383/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0361 - accuracy:
1.0000
Epoch 384/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0357 - accuracy:
1.0000
Epoch 385/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0354 - accuracy:
1.0000
Epoch 386/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0350 - accuracy:
1.0000
Epoch 387/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0346 - accuracy:
1.0000
Epoch 388/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0344 - accuracy:
1.0000
Epoch 389/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0338 - accuracy:
1.0000
Epoch 390/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0337 - accuracy:
```

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1.0000
Epoch 391/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0332 - accuracy:
1.0000
Epoch 392/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0329 - accuracy:
1.0000
Epoch 393/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0325 - accuracy:
1.0000
Epoch 394/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0321 - accuracy:
1.0000
Epoch 395/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0317 - accuracy:
1.0000
Epoch 396/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0315 - accuracy:
1.0000
Epoch 397/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0312 - accuracy:
1.0000
Epoch 398/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0307 - accuracy:
1.0000
Epoch 399/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0304 - accuracy:
1.0000
Epoch 400/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0302 - accuracy:
1.0000
Epoch 401/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0298 - accuracy:
1.0000
Epoch 402/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0294 - accuracy:
1.0000
Epoch 403/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0292 - accuracy:
1.0000
Epoch 404/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0288 - accuracy:
1.0000
Epoch 405/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0285 - accuracy:
1.0000
Epoch 406/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0282 - accuracy:
```

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1.0000
Epoch 407/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0280 - accuracy:
1.0000
Epoch 408/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0277 - accuracy:
1.0000
Epoch 409/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0275 - accuracy:
1.0000
Epoch 410/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0271 - accuracy:
1.0000
Epoch 411/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0269 - accuracy:
1.0000
Epoch 412/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0265 - accuracy:
1.0000
Epoch 413/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0263 - accuracy:
1.0000
Epoch 414/500
7/7 [==============================] - 0s 6ms/step - loss: 0.0261 - accuracy:
1.0000
Epoch 415/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0258 - accuracy:
1.0000
Epoch 416/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0255 - accuracy:
1.0000
Epoch 417/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0253 - accuracy:
1.0000
Epoch 418/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0250 - accuracy:
1.0000
Epoch 419/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0248 - accuracy:
1.0000
Epoch 420/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0245 - accuracy:
1.0000
Epoch 421/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0243 - accuracy:
1.0000
Epoch 422/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0240 - accuracy:
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1.0000
Epoch 423/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0238 - accuracy:
1.0000
Epoch 424/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0235 - accuracy:
1.0000
Epoch 425/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0234 - accuracy:
1.0000
Epoch 426/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0231 - accuracy:
1.0000
Epoch 427/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0228 - accuracy:
1.0000
Epoch 428/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0227 - accuracy:
1.0000
Epoch 429/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0224 - accuracy:
1.0000
Epoch 430/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0222 - accuracy:
1.0000
Epoch 431/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0221 - accuracy:
1.0000
Epoch 432/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0218 - accuracy:
1.0000
Epoch 433/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0216 - accuracy:
1.0000
Epoch 434/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0214 - accuracy:
1.0000
Epoch 435/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0212 - accuracy:
1.0000
Epoch 436/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0210 - accuracy:
1.0000
Epoch 437/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0208 - accuracy:
1.0000
Epoch 438/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0206 - accuracy:
```

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1.0000
Epoch 439/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0204 - accuracy:
1.0000
Epoch 440/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0202 - accuracy:
1.0000
Epoch 441/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0200 - accuracy:
1.0000
Epoch 442/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0198 - accuracy:
1.0000
Epoch 443/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0196 - accuracy:
1.0000
Epoch 444/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0194 - accuracy:
1.0000
Epoch 445/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0193 - accuracy:
1.0000
Epoch 446/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0191 - accuracy:
1.0000
Epoch 447/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0190 - accuracy:
1.0000
Epoch 448/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0188 - accuracy:
1.0000
Epoch 449/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0186 - accuracy:
1.0000
Epoch 450/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0185 - accuracy:
1.0000
Epoch 451/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0183 - accuracy:
1.0000
Epoch 452/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0182 - accuracy:
1.0000
Epoch 453/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0179 - accuracy:
1.0000
Epoch 454/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0178 - accuracy:
```

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1.0000
Epoch 455/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0176 - accuracy:
1.0000
Epoch 456/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0174 - accuracy:
1.0000
Epoch 457/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0174 - accuracy:
1.0000
Epoch 458/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0172 - accuracy:
1.0000
Epoch 459/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0170 - accuracy:
1.0000
Epoch 460/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0169 - accuracy:
1.0000
Epoch 461/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0167 - accuracy:
1.0000
Epoch 462/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0165 - accuracy:
1.0000
Epoch 463/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0164 - accuracy:
1.0000
Epoch 464/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0163 - accuracy:
1.0000
Epoch 465/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0162 - accuracy:
1.0000
Epoch 466/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0160 - accuracy:
1.0000
Epoch 467/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0159 - accuracy:
1.0000
Epoch 468/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0158 - accuracy:
1.0000
Epoch 469/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0156 - accuracy:
1.0000
Epoch 470/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0155 - accuracy:
```

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1.0000
Epoch 471/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0153 - accuracy:
1.0000
Epoch 472/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0152 - accuracy:
1.0000
Epoch 473/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0151 - accuracy:
1.0000
Epoch 474/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0149 - accuracy:
1.0000
Epoch 475/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0148 - accuracy:
1.0000
Epoch 476/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0147 - accuracy:
1.0000
Epoch 477/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0145 - accuracy:
1.0000
Epoch 478/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0144 - accuracy:
1.0000
Epoch 479/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0143 - accuracy:
1.0000
Epoch 480/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0142 - accuracy:
1.0000
Epoch 481/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0141 - accuracy:
1.0000
Epoch 482/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0140 - accuracy:
1.0000
Epoch 483/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0138 - accuracy:
1.0000
Epoch 484/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0137 - accuracy:
1.0000
Epoch 485/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0136 - accuracy:
1.0000
Epoch 486/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0135 - accuracy:
```

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1.0000
Epoch 487/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0134 - accuracy:
1.0000
Epoch 488/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0133 - accuracy:
1.0000
Epoch 489/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0132 - accuracy:
1.0000
Epoch 490/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0131 - accuracy:
1.0000
Epoch 491/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0130 - accuracy:
1.0000
Epoch 492/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0128 - accuracy:
1.0000
Epoch 493/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0127 - accuracy:
1.0000
Epoch 494/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0126 - accuracy:
1.0000
Epoch 495/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0126 - accuracy:
1.0000
Epoch 496/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0125 - accuracy:
1.0000
Epoch 497/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0123 - accuracy:
1.0000
Epoch 498/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0123 - accuracy:
1.0000
Epoch 499/500
7/7 [==============================] - 0s 5ms/step - loss: 0.0121 - accuracy:
1.0000
Epoch 500/500
7/7 [==============================] - 0s 4ms/step - loss: 0.0120 - accuracy:
1.0000
```

[101]:
```
# to save the trained model
model.save("chat_model")
```

```
import pickle

# to save the fitted tokenizer
with open('tokenizer.pickle', 'wb') as handle:
    pickle.dump(tokenizer, handle, protocol=pickle.HIGHEST_PROTOCOL)

# to save the fitted label encoder
with open('label_encoder.pickle', 'wb') as ecn_file:
    pickle.dump(lbl_encoder, ecn_file, protocol=pickle.HIGHEST_PROTOCOL)
```

```
WARNING:absl:Found untraced functions such as _update_step_xla while saving
(showing 1 of 1). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: chat_model\assets

INFO:tensorflow:Assets written to: chat_model\assets
```

[102]:
```
import json
import numpy as np
from tensorflow import keras
from sklearn.preprocessing import LabelEncoder

import colorama
colorama.init()
from colorama import Fore, Style, Back

import random
import pickle

with open("intents.json") as file:
    data = json.load(file)


def chat():
    # load trained model
    model = keras.models.load_model('chat_model')

    # load tokenizer object
    with open('tokenizer.pickle', 'rb') as handle:
        tokenizer = pickle.load(handle)

    # load label encoder object
    with open('label_encoder.pickle', 'rb') as enc:
        lbl_encoder = pickle.load(enc)

    # parameters
    max_len = 20
```

```
    while True:
        print(Fore.LIGHTBLUE_EX + "User >> " + Style.RESET_ALL, end="")
        inp = input()
        if inp.lower() == "quit" or inp.lower() == "q":
            break

        result = model.predict(keras.preprocessing.sequence.
↪pad_sequences(tokenizer.texts_to_sequences([inp]),
                                             truncating='post', maxlen=max_len))
        tag = lbl_encoder.inverse_transform([np.argmax(result)])

        for i in data['intents']:
            if i['tag'] == tag:
                print(Fore.GREEN + "ChatBot >>" + Style.RESET_ALL , np.random.
↪choice(i['responses']))
```

[103]:
```
print(Fore.YELLOW + "Start messaging with the bot (type quit or q to stop)!" +␣
↪Style.RESET_ALL)
chat()
```

```
Start messaging with the bot (type quit to stop)!
User >> q
```

thanks for reading