

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
“Київський політехнічний інститут ім. Ігоря Сікорського”
ФАКУЛЬТЕТ Інформатики та Обчислювальної Техніки
КАФЕДРА Інформаційних систем та технологій

Звіт до лабораторної роботи №8
з предмету: Обробка та Аналіз текстових даних на мові
Python

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Тема: Навчання моделей spaCy

Мета: Ознайомитись з додаванням власних прикладів до моделей spaCy та компонентом для класифікації текстів.

Варіант: 11

Завдання:

Створити програму, яка:

1. Створити кілька своїх прикладів у форматі json за тематикою варіанту для розпізнавання нового типу сутностей. Створити програму, що додає ці приклади до існуючої моделі spaCy, навчає модель. Продемонструвати роботу.
2. Застосувати компонент TextCategorizer для визначення намірів. Дані для навчання за тематикою варіанту обрати самостійно, або скористатись вказаним файлом. Дані файли містять приклади діалогів користувачів з системою-помічником за певною тематикою, наприклад, замовлення квитків і т.д. Навчити компонент та продемонструвати роботу.

Код програми

Завдання 1:

```
#!/usr/bin/env python3

import json
import random

import spacy
from spacy.training import Example

model = "trained_model"

# load the model
if model is not None:
    nlp = spacy.load(model)
    print("Loaded model '%s'" % model)
else:
    nlp = spacy.load("en_core_web_md")
    print("Loaded en_core_web_md model")

with open("own_set.json", "r") as file:
    examples = json.loads(file.read())

n_iter = 20
```

```

other_pipes = [pipe for pipe in nlp.pipe_names if pipe != "ner"]
with nlp.disable_pipes(*other_pipes): # only train NER
    optimizer = nlp.create_optimizer()
    for itn in range(n_iter):
        random.shuffle(examples)
        losses = {}
        for example in examples:
            text = example["utterance"]
            doc = nlp.make_doc(text)
            annotations = {"entities": []}
            for ent in example["entities"]:
                annotations["entities"].append(
                    (
                        ent["start"],
                        ent["end"],
                        example["intent"],
                    )
                )

            # print(annotations)
            ex = Example.from_dict(doc, annotations)
            nlp.update([ex], drop=0.5, sgd=optimizer, losses=losses)

        print(losses)

nlp.to_disk("trained_model")

text = (
    "I want to open new account. "
    + "Thank you for helping me to restore my account. "
    + "Can I create new savings account?"
    + "How to restore my password? "
    + "I cannot access my account"
)

doc = nlp(text)
for ent in doc.ents:
    print(ent.text, ent.label_)

```

Завдання 2:

!/usr/bin/env python3

```

import json
import random

import spacy
from spacy.training import Example
from spacy.pipeline.textcat import DEFAULT_SINGLE_TEXTCAT_MODEL
from sklearn.model_selection import train_test_split

config = {"threshold": 0.5, "model": DEFAULT_SINGLE_TEXTCAT_MODEL}

```

```

model = None # "trained_model2"

# load the model
if model is not None:
    nlp = spacy.load(model)
    print("Loaded model '%s'" % model)
else:
    nlp = spacy.load("en_core_web_md")
    print("Loaded en_core_web_md model")

with open("banks.json", "r") as file:
    data = json.loads(file.read())

training_data = []
for dialogue in data:
    for turn in dialogue["turns"]:
        if turn["speaker"] == "USER":
            utterance = turn["utterance"]
            intent = None

            for frame in turn["frames"]:
                for action in frame["actions"]:
                    if action["act"] == "INFORM_INTENT":
                        intent = action["values"][0]
                        break

            if intent is not None:
                training_data.append((utterance, intent))

train_data, valid_data = train_test_split(
    training_data, test_size=0.4, random_state=1, shuffle=True
)

n_iter = 10

if "textcat" not in nlp.pipe_names:
    textcat = nlp.add_pipe("textcat", config=config)
    for _, intent in training_data:
        textcat.add_label(intent)

    train_examples = [
        Example.from_dict(nlp.make_doc(text), {"cats": {label: 1}})
        for text, label in training_data
    ]
    textcat.initialize(lambda: train_examples, nlp=nlp)
else:
    textcat = nlp.get_pipe("textcat")

with nlp.select_pipes(enable="textcat"):
    optimizer = nlp.resume_training()
    for itn in range(n_iter):
        random.shuffle(train_data)

```

```

losses = {}
for text, label in train_data:
    # if label == "ReserveHotel":
    #     print(text, " | ", label)
    doc = nlp.make_doc(text)
    ex = Example.from_dict(doc, {"cats": {label: 1}})
    nlp.update([ex], sgd=optimizer, losses=losses)
print(losses)

```

```
nlp.to_disk("trained_model2")
```

```
# Оцінка моделі на перевіірочних даних
```

```
eval_results = {}
```

```

for text, label in valid_data:
    doc = nlp(text)
    predicted_label = max(doc.cats, key=doc.cats.get)
    print(doc, predicted_label)
    if predicted_label not in eval_results:
        eval_results[predicted_label] = {"tp": 0, "fp": 0, "fn": 0}
    if label not in eval_results:
        eval_results[label] = {"tp": 0, "fp": 0, "fn": 0}
    if predicted_label == label:
        eval_results[predicted_label]["tp"] += 1
    else:
        eval_results[predicted_label]["fp"] += 1
        eval_results[label]["fn"] += 1

```

```
# Виведення результатів оцінки
```

```

for label, metrics in eval_results.items():
    try:
        precision = metrics["tp"] / (metrics["tp"] + metrics["fp"])
    except ZeroDivisionError:
        precision = 0

    try:
        recall = metrics["tp"] / (metrics["tp"] + metrics["fn"])
    except ZeroDivisionError:
        recall = 0

    try:
        f1_score = 2 * (precision * recall) / (precision + recall)
    except ZeroDivisionError:
        f1_score = 0
    print(f"Label: {label}")
    print(f"Precision: {precision}")
    print(f"Recall: {recall}")
    print(f"F1-Score: {f1_score}")

```

Результат роботи програми

Завдання 1:

```
Loaded model 'trained_model'
{'ner': 1.9590531995237086}
{'ner': 8.563496639773872e-05}
{'ner': 0.5188560753318333}
{'ner': 0.001368503319936956}
{'ner': 0.02435395200031096}
{'ner': 0.003741263082236634}
{'ner': 3.926288019536599}
{'ner': 0.7604196460004635}
{'ner': 0.01162161662632768}
{'ner': 0.24750136687335073}
{'ner': 0.3183880576801417}
{'ner': 3.3104173227448297}
{'ner': 1.8669747686328468}
{'ner': 6.539719468916178}
{'ner': 2.8494397325940697}
{'ner': 5.181474338740525}
{'ner': 5.2804218718061495}
{'ner': 1.819302682305865}
{'ner': 0.3983932955359005}
{'ner': 1.2692593892436377}
open open_account
account open_account
helping me interest_rates
restore my account password_reset
create new savings password_reset
restore my password password_reset
cannot password_reset
access my account password_reset
```

Завдання 2:

```
Loaded en_core_web_md model
{'textcat': 12.885777256167671}
{'textcat': 0.8203631277321289}
{'textcat': 0.0004907100514969231}
{'textcat': 9.243250025540994e-06}
{'textcat': 3.981955033319912e-06}
{'textcat': 2.1103996967544725e-06}
{'textcat': 1.2454077911901174e-06}
```

{'textcat': 7.787593562782677e-07}

{'textcat': 5.271530222105206e-07}

{'textcat': 3.68531435095739e-07}

I need to make a transfer to Abhinav's checking account. TransferMoney

I need to transfer some money to a friend. TransferMoney

Great, thanks! Can I check my balance? CheckBalance

I need a place to stay until the 14th. TransferMoney

I wanna make a transfer. TransferMoney

I would like to make a bank transfer please TransferMoney

Hey there. I need to make a hotel reservation on March 4th for a business trip.

ReserveHotel

I told my wife to make a money transfer but she forgot. Will you make a transfer for me? TransferMoney

I want to make a hotel reservation for Saturday this week ReserveHotel

I need to transfer some money. TransferMoney

I need to send a payment from my checking account to Amir for a loan he gave me a while back. ReserveHotel

My friend is need of some money. Would you help me make a transfer?

TransferMoney

I'm interested in making a money transfer. TransferMoney

Hello, I would be needing assistance in making a transfer. TransferMoney

Thank you. What is my balance? CheckBalance

I need to reserve 3 rooms at a hotel. ReserveHotel

I need to make a transfer. TransferMoney

Thanks a lot. Please check the balance of my checking account too. CheckBalance

Great! Can you tell me what my checking account balance is? CheckBalance

I would like to make a transfer. TransferMoney

I want to transfer funds. TransferMoney

What is my checking account balance? CheckBalance

Thanks a bunch. How much money is in my checking account? CheckBalance

Go with my checking account as i need to make a transfer TransferMoney

I want to book a room in a hotel. ReserveHotel

Hello, can you help me make a hotel reservation? ReserveHotel

I would like to transfer 1320 dollars to their savings account. TransferMoney

Thank you for that, now can I have my balance? CheckBalance

Can you transfer three hundred and seventy bucks? TransferMoney

I want to make a hotel reservation at Chicago Lake Shore checking in the 2nd of this month. ReserveHotel

Can you make a transfer from my checking account for me? TransferMoney

I'd like to make a hotel reservation, please. ReserveHotel

I would like to transfer some money to one of their savings account, can you help me? TransferMoney

What's my balance? CheckBalance

Okay great, what is my balance in my checking account? CheckBalance

I want to know the balance of my account, go with checking account. CheckBalance

I would like to make a bank transfer. TransferMoney

I wanna check the balance in the checking account CheckBalance

Fantastic. Can you please tell me the balance of my checking account?

CheckBalance

Now can you provide me with an updated balance on my checking account?

CheckBalance

Thank you. Could you tell me my checking account balance please? CheckBalance

I want to check my checking account's balance. CheckBalance

Can you assist me in transferring funds from my savings account? ReserveHotel

I want to stay in a hotel. Please find hotels in Paris, France. ReserveHotel

Can you help me make a transfer please? TransferMoney

i'd like to try booking again. Let's stay at Homewood Suites, checking in on March 3rd. ReserveHotel

Thank you, can you check my balance in my checking account. CheckBalance

Thanks. Also, can I see my checking account balance? CheckBalance

I want to make a transfer. TransferMoney

I need to transfer money to someone's savings account. TransferMoney

I want to transfer some money to a checking account. TransferMoney

I would like to transfer some money from my checking account. TransferMoney

Hey, I need to make a money transfer. TransferMoney

What is my checking account balance? CheckBalance

Cool, now I need to know my balance CheckBalance

Can I check my balance now? CheckBalance

I'm looking to transfer from my account. TransferMoney

I'd like to make a bank transfer - can you help me out? TransferMoney

Thanks for it and please check the balance in my checking account. CheckBalance

What's my balance? CheckBalance

I need to make a transfer. TransferMoney

I need a hotel reservation. ReserveHotel

I want to make a payment so I want to make a transfer. TransferMoney

I want to make a hotel reservation. ReserveHotel

Hey. I want to find a hotel in or around San Francisco. ReserveHotel

Thanks for you needful help and also i need to check my balance. Will you tell me? CheckBalance

Yes, I'd like to check my balance. CheckBalance

I need to transfer 130 dollars. TransferMoney

Now check my balance please CheckBalance

I have to do my balance check CheckBalance

I need to make a transfer to Sanuj, to their checking account please.

TransferMoney

Please reserve a hotel for me. ReserveHotel

I want to make a bank transfer. TransferMoney
I would like to reserve 1 room at a hotel checking out on March 14th.
ReserveHotel
I want to transfer some money. TransferMoney
Can I check my balance? CheckBalance
Can you check the balance of my checking account? CheckBalance
I need to make a transfer. TransferMoney
It just came up in my mind that I need to make a hotel reservation and I need an assistant in doing so. ReserveHotel
Now I would like to verify my balance CheckBalance
Great, tell me my updated balance. CheckBalance
Thanks, what's my balance? CheckBalance
I wanted to transfer some smoney TransferMoney
I want some money to my friend who is in urgency, Can you help? TransferMoney
Thank you, what is my checking balance? CheckBalance
I want to know my balance. CheckBalance
I want to make a fund transfer TransferMoney
What's my balance? CheckBalance
Fine, please check my balance. CheckBalance
I'd like to make a bank transfer, can you help? TransferMoney
What's my checking account balance? CheckBalance
I'd like to make a transfer from my savings to their savings TransferMoney
Can you go to my checking account now and give me the balance there?
CheckBalance
Label: TransferMoney
Precision: 0.9743589743589743
Recall: 0.95
F1-Score: 0.9620253164556962
Label: CheckBalance
Precision: 1.0
Recall: 1.0
F1-Score: 1.0
Label: ReserveHotel
Precision: 0.8823529411764706
Recall: 0.9375
F1-Score: 0.9090909090909091