15.6: SPIDERING TWITTER USING A DATABASE

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In this section, we will create a simple spidering program that will go through Twitter accounts and build a database of them. *Note: Be very careful when running this program. You do not want to pull too much data or run the program for too long and end up having your Twitter access shut off.*

One of the problems of any kind of spidering program is that it needs to be able to be stopped and restarted many times and you do not want to lose the data that you have retrieved so far. You don't want to always restart your data retrieval at the very beginning so we want to store data as we retrieve it so our program can start back up and pick up where it left off.

We will start by retrieving one person's Twitter friends and their statuses, looping through the list of friends, and adding each of the friends to a database to be retrieved in the future. After we process one person's Twitter friends, we check in our database and retrieve one of the friends of the friend. We do this over and over, picking an "unvisited" person, retrieving their friend list, and adding friends we have not seen to our list for a future visit.

We also track how many times we have seen a particular friend in the database to get some sense of their "popularity".

By storing our list of known accounts and whether we have retrieved the account or not, and how popular the account is in a database on the disk of the computer, we can stop and restart our program as many times as we like.

This program is a bit complex. It is based on the code from the exercise earlier in the book that uses the Twitter API.

Here is the source code for our Twitter spidering application:

```
from urllib.request import urlopen
import urllib.error
import twurl
import json
import sqlite3
import ssl

TWITTER_URL = 'https://api.twitter.com/1.1/friends/list.json'

conn = sqlite3.connect('spider.sqlite')
cur = conn.cursor()

cur.execute('''
            CREATE TABLE IF NOT EXISTS Twitter
            (name TEXT, retrieved INTEGER, friends INTEGER)''')

# Ignore SSL certificate errors
ctx = ssl.create_default_context()
ctx.check_hostname = False
ctx.verify_mode = ssl.CERT_NONE

while True:
    acct = input('Enter a Twitter account, or quit: ')
    if (acct == 'quit'): break
    if (len(acct) < 1):
        cur.execute('SELECT name FROM Twitter WHERE retrieved = 0 LIMIT 1')
        try:
            acct = cur.fetchone()[0]
        except:
            print('No unretrieved Twitter accounts found')
            continue
```

```
    url = twurl.augment(TWITTER_URL, {'screen_name': acct, 'count': '5'})
    print('Retrieving', url)
    connection = urlopen(url, context=ctx)
    data = connection.read().decode()
    headers = dict(connection.getheaders())

    print('Remaining', headers['x-rate-limit-remaining'])
    js = json.loads(data)
    # Debugging
    # print json.dumps(js, indent=4)

    cur.execute('UPDATE Twitter SET retrieved=1 WHERE name = ?', (acct, ))

    countnew = 0
    countold = 0
    for u in js['users']:
        friend = u['screen_name']
        print(friend)
        cur.execute('SELECT friends FROM Twitter WHERE name = ? LIMIT 1',
                    (friend, ))
        try:
            count = cur.fetchone()[0]
            cur.execute('UPDATE Twitter SET friends = ? WHERE name = ?',
                        (count+1, friend))
            countold = countold + 1
        except:
            cur.execute('''INSERT INTO Twitter (name, retrieved, friends)
                        VALUES (?, 0, 1)''', (friend, ))
            countnew = countnew + 1
    print('New accounts=', countnew, ' revisited=', countold)
    conn.commit()

cur.close()

# Code: http://www.py4e.com/code3/twspider.py
```

Our database is stored in the file `spider.sqlite3` and it has one table named `Twitter`. Each row in the `Twitter` table has a column for the account name, whether we have retrieved the friends of this account, and how many times this account has been "friended".

In the main loop of the program, we prompt the user for a Twitter account name or "quit" to exit the program. If the user enters a Twitter account, we retrieve the list of friends and statuses for that user and add each friend to the database if not already in the database. If the friend is already in the list, we add 1 to the `friends` field in the row in the database.

If the user presses enter, we look in the database for the next Twitter account that we have not yet retrieved, retrieve the friends and statuses for that account, add them to the database or update them, and increase their `friends` count.

Once we retrieve the list of friends and statuses, we loop through all of the `user` items in the returned JSON and retrieve the `screen_name` for each user. Then we use the `SELECT` statement to see if we already have stored this particular `screen_name` in the database and retrieve the friend count (`friends`) if the record exists.

```
countnew = 0
countold = 0
for u in js['users'] :
    friend = u['screen_name']
    print(friend)
    cur.execute('SELECT friends FROM Twitter WHERE name = ? LIMIT 1',
        (friend, ) )
    try:
        count = cur.fetchone()[0]
        cur.execute('UPDATE Twitter SET friends = ? WHERE name = ?',
            (count+1, friend) )
        countold = countold + 1
    except:
        cur.execute('''INSERT INTO Twitter (name, retrieved, friends)
            VALUES ( ?, 0, 1 )''', ( friend, ) )
        countnew = countnew + 1
print('New accounts=',countnew,' revisited=',countold)
conn.commit()
```

Once the cursor executes the `SELECT` statement, we must retrieve the rows. We could do this with a `for` statement, but since we are only retrieving one row (`LIMIT 1`), we can use the `fetchone()` method to fetch the first (and only) row that is the result of the `SELECT` operation. Since `fetchone()` returns the row as a *tuple* (even though there is only one field), we take the first value from the tuple using to get the current friend count into the variable `count` .

If this retrieval is successful, we use the SQL `UPDATE` statement with a `WHERE` clause to add 1 to the `friends` column for the row that matches the friend's account. Notice that there are two placeholders (i.e., question marks) in the SQL, and the second parameter to the `execute()` is a two-element tuple that holds the values to be substituted into the SQL in place of the question marks.

If the code in the `try` block fails, it is probably because no record matched the `WHERE name = ?` clause on the SELECT statement. So in the `except` block, we use the SQL `INSERT` statement to add the friend's `screen_name` to the table with an indication that we have not yet retrieved the `screen_name` and set the friend count to zero.

So the first time the program runs and we enter a Twitter account, the program runs as follows:

```
Enter a Twitter account, or quit: drchuck
Retrieving http://api.twitter.com/1.1/friends ...
New accounts= 20  revisited= 0
Enter a Twitter account, or quit: quit
```

Since this is the first time we have run the program, the database is empty and we create the database in the file `spider.sqlite3` and add a table named `Twitter` to the database. Then we retrieve some friends and add them all to the database since the database is empty.

At this point, we might want to write a simple database dumper to take a look at what is in our `spider.sqlite3` file:

```
import sqlite3

conn = sqlite3.connect('spider.sqlite')
cur = conn.cursor()
cur.execute('SELECT * FROM Twitter')
count = 0
for row in cur:
    print(row)
    count = count + 1
print(count, 'rows.')
cur.close()

# Code: http://www.py4e.com/code3/twdump.py
```

This program simply opens the database and selects all of the columns of all of the rows in the table `Twitter`, then loops through the rows and prints out each row.

If we run this program after the first execution of our Twitter spider above, its output will be as follows:

```
('opencontent', 0, 1)
('lhawthorn', 0, 1)
('steve_coppin', 0, 1)
('davidkocher', 0, 1)
('hrheingold', 0, 1)
...
20 rows.
```

We see one row for each `screen_name`, that we have not retrieved the data for that `screen_name`, and everyone in the database has one friend.

Now our database reflects the retrieval of the friends of our first Twitter account (*drchuck*). We can run the program again and tell it to retrieve the friends of the next "unprocessed" account by simply pressing enter instead of a Twitter account as follows:

```
Enter a Twitter account, or quit:
Retrieving http://api.twitter.com/1.1/friends ...
New accounts= 18  revisited= 2
Enter a Twitter account, or quit:
Retrieving http://api.twitter.com/1.1/friends ...
New accounts= 17  revisited= 3
Enter a Twitter account, or quit: quit
```

Since we pressed enter (i.e., we did not specify a Twitter account), the following code is executed:

```
if ( len(acct) < 1 ) :
    cur.execute('SELECT name FROM Twitter WHERE retrieved = 0 LIMIT 1')
    try:
        acct = cur.fetchone()[0]
    except:
        print('No unretrieved twitter accounts found')
        continue
```

We use the SQL `SELECT` statement to retrieve the name of the first (`LIMIT 1`) user who still has their "have we retrieved this user" value set to zero. We also use the `fetchone()[0]` pattern within a try/except block to either extract a `screen_name` from the retrieved data or put out an error message and loop back up.

If we successfully retrieved an unprocessed `screen_name`, we retrieve their data as follows:

```
url=twurl.augment(TWITTER_URL,{'screen_name': acct,'count': '20'})
print('Retrieving', url)
connection = urllib.urlopen(url)
data = connection.read()
js = json.loads(data)

cur.execute('UPDATE Twitter SET retrieved=1 WHERE name = ?',(acct, ))
```

Once we retrieve the data successfully, we use the `UPDATE` statement to set the `retrieved` column to 1 to indicate that we have completed the retrieval of the friends of this account. This keeps us from retrieving the same data over and over and keeps us progressing forward through the network of Twitter friends.

If we run the friend program and press enter twice to retrieve the next unvisited friend's friends, then run the dumping program, it will give us the following output:

```
('opencontent', 1, 1)
('lhawthorn', 1, 1)
('steve_coppin', 0, 1)
('davidkocher', 0, 1)
('hrheingold', 0, 1)
...
('cnxorg', 0, 2)
('knoop', 0, 1)
('kthanos', 0, 2)
('LectureTools', 0, 1)
...
55 rows.
```

We can see that we have properly recorded that we have visited `lhawthorn` and `opencontent`. Also the accounts `cnxorg` and `kthanos` already have two followers. Since we now have retrieved the friends of three people (`drchuck`, `opencontent`, and `lhawthorn`) our table has 55 rows of friends to retrieve.

Each time we run the program and press enter it will pick the next unvisited account (e.g., the next account will be `steve_coppin`), retrieve their friends, mark them as retrieved, and for each of the friends of `steve_coppin` either add them to the end of the database or update their friend count if they are already in the database.

Since the program's data is all stored on disk in a database, the spidering activity can be suspended and resumed as many times as you like with no loss of data.