Review of SURF-2017 --- Server part

By: Zhenghang Zhong (Klaus)
Indoor Localization --- Background problems

Key words:

- RSS: Received signal strength (usually between 0dbm and -90dbm)
- RSSI: Received signal strength Indication (adjusted RSS presented as a positive value)
- SSID (ESSID): Service Set Identifier (changeable)
- BSSID: mac address of the service (unique)
- AP: Accessing point
- TOA: Time of arrival
- TDOA: Time difference of arrival
- AOA: Angle of arrival
Why not GPS

- No direct line of sight between satellites and receives.

Why choose RF fingerprinting schemes

- Widespread network devices --- easily deployable.
- Reasonable performance
- Affordable cost
Algorithms used in Indoor Localization

1. Triangulation algorithm

![Diagram of triangulation algorithm](image)
Algorithms used in Indoor Localization

2. **Fingerprint localization algorithm**

1. Data collection and storage.

2. Train the neural network and model generation

3. Testing.
Fingerprint localization algorithm

1. Data collection and storage.
<table>
<thead>
<tr>
<th>ID</th>
<th>BSSID</th>
<th>Level</th>
<th>Room</th>
<th>Model</th>
<th>Time</th>
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<tbody>
<tr>
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<td>OPPO A57</td>
<td>2017-08-16 10:...</td>
</tr>
</tbody>
</table>
Fingerprint localization algorithm

2. Train the neural network and model generation

This part is carried out by Jeff Wong, with the collected data it is able to generate a DNN-based indoor localization model.

3. Testing.

- client (Android mobile phone with WiFiScanner, or Raspberry Pi)
- server with localization algorithm
- Communication though hyper text transfer protocol (HTTP)
WampServer

- Quick start up and prototyping
- Complete environment
Anaconda (set up the environment)

- Python + R, data science + machine learning
- multi-platform --- Windows, Linux, and Mac OS X
- Libraries management
Download and Installation

Anaconda 5.2 For Windows Installer

Python 3.6 version
- Download
  - 64-Bit Graphical Installer (631 MB)
  - 32-Bit Graphical Installer (506 MB)

Python 2.7 version
- Download
  - 64-Bit Graphical Installer (564 MB)
  - 32-Bit Graphical Installer (443 MB)
Conda testing

Just like **git** command, the **conda** is both packages manager and environment manager. After the installation, to test if **conda** works well.

```
1  Windows + R
2  cmd
3  conda --version ::it return the version of conda
```

```
1  conda update conda
2  ::check the update detials and confirm
3  y
```
Build up the first environment

```bash
conda create --name <environmen_name> python=3.5
```

Solving environment: done

## Package Plan ##

- environment location: C:\A_programs\Anaconda\envs\testing
- added / updated specs:
  - python=3.5

The following NEW packages will be INSTALLED:

- certifi: 2018.4.16-py35_0
- pip: 10.0.1-py35_0
- python: 3.5.5-h0c2934d_2
- setuptools: 39.2.0-py35_0
- vc: 14-h0510ff6_3
- vs2015_runtime: 14.0.25123-3
- wheel: 0.31.1-py35_0
- wincertstore: 0.2-py35hfebbdb8_0
Packages management

| 1 | conda list ::display all installed packages |
| 2 | conda search <package_name> ::check if packages are available |

For some packages that cannot be installed by conda, we could use pip which has been prepared in Anaconda.
Web frameworks

- **Django** is popular but heavy and complex.
- **web.py** is light but not maintained now.
- **tornado** has not much libraries as flask, may need some repetitive work.
- **flask** is light, popular, flexible, and extensible.
• microframework for python

• Based on Werkzeug (The python WSGI Utility Library)
  and Jinja2 (a full featured template engine for Python)

• Flexible, extensible.
More reasons

- flask + DL framework
- Python 3.5
- POST and GET methods
RESTful framework

Representational State Transfer (REST) is an architectural style that defines a set of constraints and properties based on HTTP.

- **GET** -- Provides a read only access to a resource.
- **PUT** -- Used to create a new resource.
- **DELETE** -- Used to remove a resource.
- **POST** -- Used to update an existing resource or create a new resource.
<table>
<thead>
<tr>
<th>Uniform Resource Locator (URL)</th>
<th>GET</th>
<th>PUT</th>
<th>PATCH</th>
<th>POST</th>
<th>DELETE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collection, such as</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="https://api.example.com/resources/">https://api.example.com/resources/</a></td>
<td>List the URIs and perhaps other details of the collection's members.</td>
<td>Replace the entire collection with another collection.</td>
<td>Not generally used</td>
<td>Create a new entry in the collection. The new entry's URI is assigned automatically and is usually returned by the operation.</td>
<td>Delete the entire collection.</td>
</tr>
<tr>
<td><strong>Element, such as</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="https://api.example.com/resources/item17">https://api.example.com/resources/item17</a></td>
<td>Retrieve a representation of the addressed member of the collection, expressed in an appropriate Internet media type.</td>
<td>Replace the addressed member of the collection, or if it does not exist, create it.</td>
<td>Update the addressed member of the collection.</td>
<td>Not generally used. Treat the addressed member as a collection in its own right and create a new entry within it.</td>
<td>Delete the addressed member of the collection.</td>
</tr>
</tbody>
</table>
Installation for Windows

```
cd <environment_name>\Scripts :: all below packages should be installed under folder Scripts
pip install flask
pip install msgpack
pip install flask-login
pip install flask-openid
pip install flask-sqlalchemy
pip install sqlalchemy-migrate
pip install flask-whooshalchemy
pip install flask-wtf
pip install flask-babel
pip install guess_language
pip install flipflop
pip install coverage
```
Installation for Linux, OS X or Cygwin

```
# You'd better try pip3 instead of pip, in case both python2 an python3 exist

cd <environment_name>/Scripts

# all below packages should be installed under
# folder Scripts

pip install flask
pip install msgpack
pip install flask-login
pip install flask-openid
pip install flask-mail
pip install flask-sqlalchemy
pip install sqlalchemy-migrate
pip install flask-whooshalchemy
pip install flask-wtf
pip install flask-babel
pip install guess_language
pip install flipflop
pip install coverage
```
## Copy and paste relevant files

<table>
<thead>
<tr>
<th>Directory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papers</td>
<td>Add Paper about Hierarchical Classification</td>
</tr>
<tr>
<td>SURF_DATA</td>
<td>Revert &quot;Adding database part (using sqlite3) and relevant code&quot;</td>
</tr>
<tr>
<td>algorithm</td>
<td>Update dataset</td>
</tr>
<tr>
<td>android</td>
<td>Wifi.Scanner</td>
</tr>
<tr>
<td>data_collection</td>
<td>Upload poster</td>
</tr>
<tr>
<td>flask</td>
<td>Merge pull request #8 from ZzhKlaus/master</td>
</tr>
<tr>
<td>img</td>
<td>Add oppo test acc</td>
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<tr>
<td>wifiScanner_comb_flask</td>
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<tr>
<td>.gitignore</td>
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<td>Data_Description.md</td>
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<td>Poster.pdf</td>
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<tr>
<td>README.md</td>
<td>Update README.md</td>
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## Copy and paste relevant files

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<tr>
<th>Directory</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>pycache</strong></td>
<td>Use oppo to collect data</td>
</tr>
<tr>
<td>app</td>
<td>Use oppo to collect data</td>
</tr>
<tr>
<td>trained_model</td>
<td>Adding Model and Time characters in .csv and code</td>
</tr>
<tr>
<td>config.py</td>
<td><code>flask&amp;android_file</code></td>
</tr>
<tr>
<td>db_create.py</td>
<td>Revert &quot;Adding database part (using sqlite3) and relevant code&quot;</td>
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<td>Adding the DB part and relevant code</td>
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<td>mapping.py</td>
<td>Add Timer function in android</td>
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<tr>
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</table>
Install TensorFlow and keras to run main_user file

A quick test of the file `main_user.py` need the environment of **TensorFlow (CPU version, while GPU version is optional)** and **Keras**, which could be installed by typing below commands.

```
1 pip install tensorflow
2 pip install keras
3 pip install pandas
4 pip install sklearn
5 pip install matplotlib
```

Tips: `conda install anaconda`
Address setting

- **Localhost address**: 127.0.0.1
- **IPv4 address**

```
C:\Users\zheng>ipconfig
Windows IP 配置

无线局域网适配器 本地连接* 2:
    媒体状态     : 媒体已断开连接
    连接特定的 DNS 后缀     :

无线局域网适配器 本地连接* 3:
    媒体状态     : 媒体已断开连接
    连接特定的 DNS 后缀     :

无线局域网适配器 WLAN:
    连接特定的 DNS 后缀     : DHCP HOST
    本地链接 IPv6 地址       : fe80::21a4:30b:cbc7:d577%4
    IPv4 地址               : 192.168.1.102
    子网掩码                : 255.255.255.0
    默认网关                : 192.168.1.1

以太网适配器 蓝牙网络连接:
    媒体状态     : 媒体已断开连接
    连接特定的 DNS 后缀     :
Flask Tutorial

```
app/__init__.py: Flask application instance
from flask import Flask
app = Flask(__name__)
from app import routes

app/routes.py: Home page route
from app import app
@app.route('/'
@app.route('/index')
def index():
    return "Hello, World!"
```

```
if __name__ == "__main__":
    app.run(host='127.0.0.1', debug=True)
```
Flask Tutorial

$ python microblog.py

* Debug mode: on
* Restarting with stat
* Debugger is active!
* Debugger PIN: 187-650-747
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
Hello, World!
Flask Tutorial
Improvements

1. RESTful --- GET method
   - Time Limitation
   - Be short of hands
   - Android, flask
   - Laptop, phone

2. flask-restful library
   ```
   pip install flask-restful
   ```

3. Robustness
   - Irregular inputs
   - Multi-user (multi-phones)
   - Multithreading
END