Fintech Project

## A Robotic Investor for Lending Club

WEEK 1

Overview and Schedule

- **Week 1 : Domain Knowledge and Data Preparation**
  - Lending Club 1,2,3……
  - Lending Club API
    - Request
    - Json
  - Features at a First Look
  - Data preparation
- **Week 2 : Data Exploration and Model Building**
  - Data Exploration
  - Feature Engineering (Special Features Treatment)
  - Gradient Boost Model
- **Week 3 : Demo Codes and Web Application Development**
  - Pickling
  - Routing
  - Flask

Some Key Words/Concepts

- Fintech: Financial Technology

- P2P Lending: Peer to Peer Lending

- Lending club

- Robotic Investor: Lending Robot

- Debt, Loan, Credit Card Balance

- etc

Return On Investment (ROI)

Lending Club Historical Returns
Investors in 12-15% Rated Loans
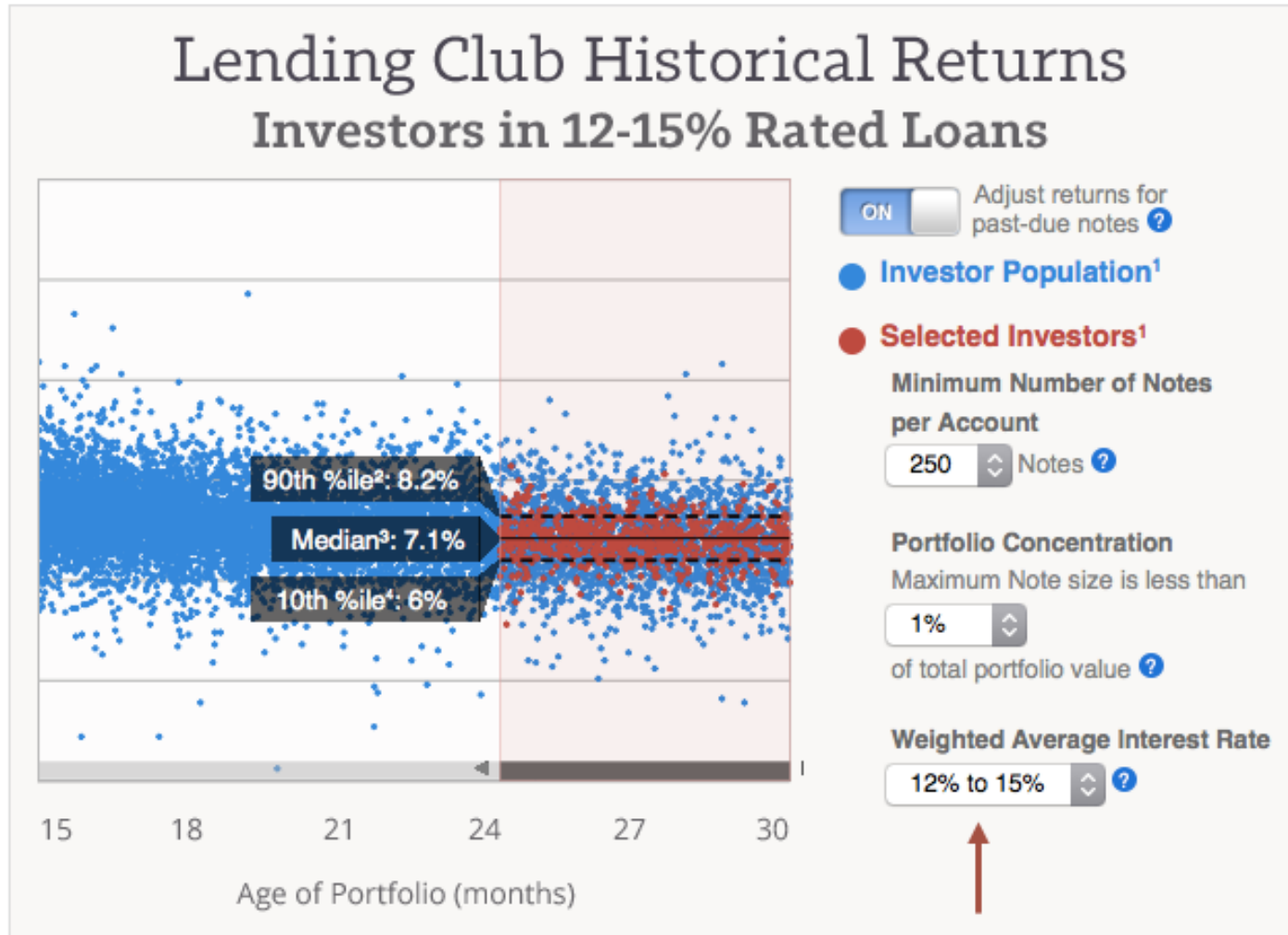
Take $10,000 and put it to work at both 6% and 8%. In 30 years your 6% account would have $57,000, while the 8% account would have $100,000.

Q1: Possible story of an issued loan?
Q2: What determines the ROI?
1. Single loan v.s. multiple
2. Expected v.s actual
3. Interest rate, default rate （risks）, service fees etc…

How to Select Potentially Higher Return Loans?
Filters v.s. Algorithm Modeling

Prosper 2014-Issued Loans
D, E, HR-grade by Recent Inquiries

	ROI ↓	Avg Rate ⇕	Loss ⇕	Principal ⇕	Interest Paid ⇕	Count ⇕
0	16.85%	22.50%	4.85%	$46,941,784.00	$2,613,545.50	5,400
>=1	15.46%	22.56%	6.44%	$44,871,332.00	$2,479,465.20	4,982

Prosper 2014-Issued Loans
D, E, HR-grades by Annual Income

	ROI ⇕	Avg Rate ⇕	Loss ⇕	Principal ⇕	Interest Paid ⇕	Count ⇕
$1-24999	14.47%	23.87%	8.46%	$2,651,908.00	$189,001.55	789
$25000-49999	16.64%	23.26%	5.78%	$39,559,976.00	$2,397,299.20	5,859
$50000-74999	15.19%	22.63%	6.69%	$53,994,208.00	$2,870,968.50	5,695
$75000-99999	14.06%	22.21%	7.51%	$30,645,524.00	$1,493,498.00	2,790
$1000000+	16.47%	22.09%	4.86%	$32,877,068.00	$1,549,760.00	2,738

Traditional Filters

My Lending Club filter (higher risk loans)

Lending Club grades: E, F, & G

Goal: 10-11% ROI

See this filter on NSR

Filter criteria:

- Inquiries: 0

- Annual income: $85,000 or more

- States: Exclude AZ, CA, FL, & NV

- Loan purpose: Exclude 'business loans'

My Prosper filter (higher risk loans)
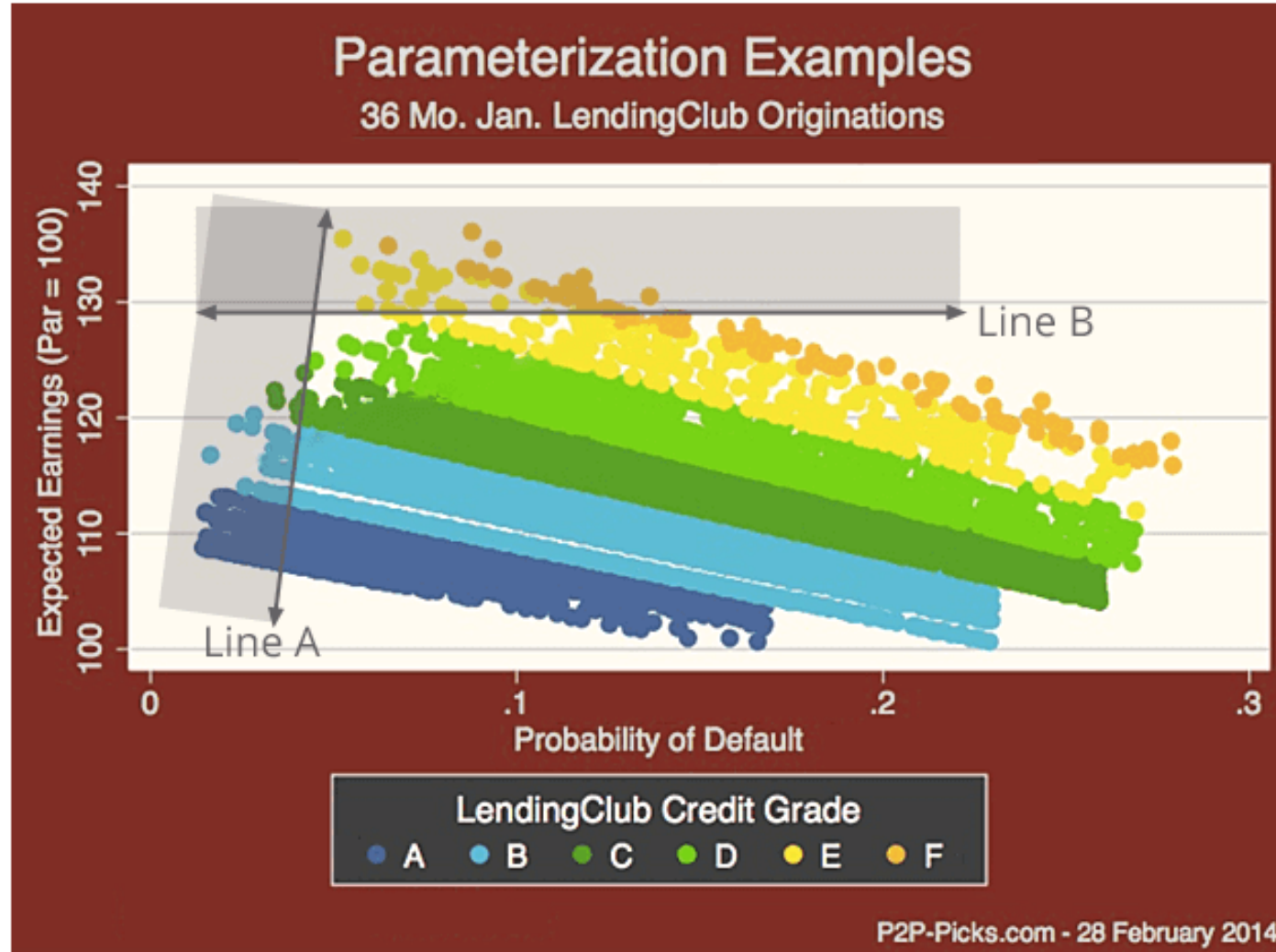
Prosper ratings: D, E, & HR

Goal: 10-11% ROI

See this filter on NSR

Filter criteria:

- Inquiries: 0

- Income: $25,000 or more

- Loan purpose: 'Debt consolidation' only

- States: Exclude CA & FL

What is a secondary credit model?

Q1:What are the differences on modeling targets and loan selections for Lending Club, third party investing service and yourself?

How about lending club v.s. a bank?

http://www.lendingmemo.com/credit-model-lending-club-prosper/

Second Credit Model VS Filter

Parameter	Estimate	Standard Error	Lower 95%	Upper 95%
FICO score (lower bound)	−0.0010293	0.0004616	−0.001936	−0.000127
Sub Grade	0.05280805	0.0019866	0.0489075	0.0566947
Loan Amount	−5.0413e−6	3.3655e−6	−1.167e−5	1.5238e−6
Debt-to-Income ratio	0.0027784	0.0015405	−0.000243	0.0057959
Open Credit Lines	−0.0177774	0.0031108	−0.023885	−0.011691
Total Credit Lines	0.00447601	0.0013291	0.0018616	0.0070715
...	...	...	...	...
Number of Delinquencies	−0.0541081	0.0175649	−0.089104	−0.020258
Number of Inquiries	0.11607386	0.0044991	0.1070607	0.1247001
Length of Employment	−0.0077227	0.0029357	−0.013478	−0.00197
Home Ownership: 'mortgage'	−0.2285397	0.1079474	−0.416494	0.0169571
Home Ownership: 'none'	0.46302684	0.4019667	−0.475457	1.1425968
Home Ownership: 'other'	0.04318891	0.1797057	−0.315094	0.3986464
Home Ownership: 'own'	−0.1689286	0.1106693	−0.363594	0.0805187
Purpose: 'Car'	−0.3688268	0.0751338	−0.519288	−0.22457
Purpose: 'Credit card'	−0.5831873	0.0376587	−0.656992	−0.509326
Purpose: 'Debt consolidation'	−0.2201599	0.0282871	−0.275089	−0.164145
Purpose: 'Educational'	0.23164711	0.1040292	0.0209673	0.4292712
Purpose: 'Home improvement'	−0.1633505	0.0469559	−0.255983	−0.07186
Purpose: 'Major purchase'	−0.2128853	0.0578053	−0.327724	−0.101034
Purpose: 'Medical'	0.1980045	0.0730734	0.0517766	0.3384039
Purpose: 'Small business'	0.59293817	0.0431258	0.5080413	0.677145
Purpose: 'Vacation'	0.07459664	0.1035141	−0.135136	0.2711493

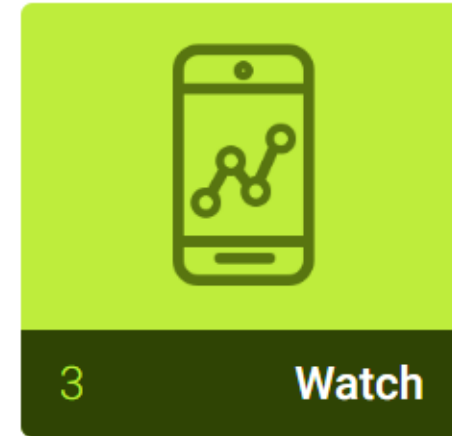# Robotic Investor

How it Works

1 Link

Connect one, or all, of your marketplace accounts to a single LendingRobot account in just a few seconds. LendingRobot supports:

LendingClub

PROSPER

2 Choose

Fully automate a customized conservative or aggressive investment strategy with one click using our simple "slider," or use our "advanced mode" to specify multiple, sophisticated rules for both the primary and secondary markets.

3 Watch

LendingRobot vigilantly scans for new loans, and will automatically invest your idle cash or sell your notes at your discretion. You're always in the loop with our daily summary report.

Available on the App Store

ANDROID APP ON Google play

Robotic Investor

Easy
Create sophisticated investment rules in a few clicks, and benefit automatically from our research

Liquid
Unique secondary market automation puts thousands of notes for sale, almost instantly, and continuously reprices loans until sale target is reached

Fast
Less than 850ms are needed between the time a loan is made available and the time LendingRobot invests

Continuous
LendingRobot is constantly re-investing loan proceeds to keep portfolios diversified and avoid cash drag

Transparent
See ongoing expected returns, cash-flow forecasts, and risk profile of a given portfolio

Sophisticated
LendingRobot's machine learning algorithms are the result of years of research in data science and optimization

Affordable
LendingRobot is free for up to $5,000 in managed assets and only 0.45% per year above that

Acclaimed
Having attracted thousands of clients as well as press attention, LendingRobot is a recognized leader in the peer lending space

Robotic Investor

Robotic Investor

Investment Criteria Details

	A	B	C	D	E	F	G
New Target Allocation	8 %	27 %	34 %	19 %	8 %	3 %	1 %
Your Current Allocation	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Historical Inventory[7]	8.39%	26.84%	34.30%	18.51%	7.80%	3.24%	0.92%
Effective Interest Rate[3]	6.98%	10.49%	13.81%	17.85%	22.35%	27.01%	28.05%
Avg Expected Charge Off Rate[4]	1.83%	3.98%	6.49%	9.66%	13.35%	17.66%	18.22%
Projected Return[1]	4.38%	5.72%	6.50%	7.32%	8.22%	8.56%	9.06%

How to set a cash reserve >

Investment Amount per Note $ [25] ($25 min)

Note Term   ◉ Both   ◯ 36 Month Only   ◯ 60 Month Only

Special Instructions (Not Required) >

A	8%
B	27%
C	34%
D	19%
E	8%
F	3%
G	1%
$	0%
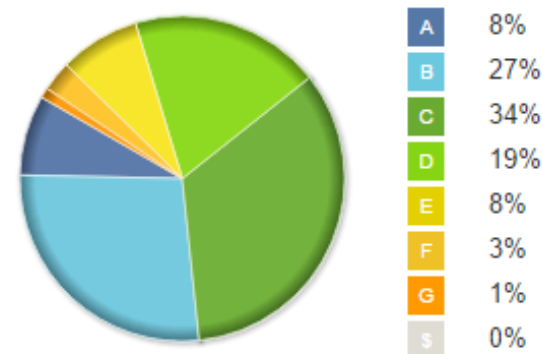
Total: 100%

Allocation Summary

Effective Interest Rate:	14.36%[3]
Expected Charge Off Rate:	7.04%[4]
Estimated Fees:	0.81%[6]
Projected Return: ➡	**6.51%[1]**
Historical Returns Range:	5.54% - 8.39%[2]

Lending Club Historic Data

https://www.lendingclub.com/info/download-data.action

API Basics

- **Server:** A powerful computer that runs an API
- **API:** The "hidden" portion of a website that is meant for computer consumption
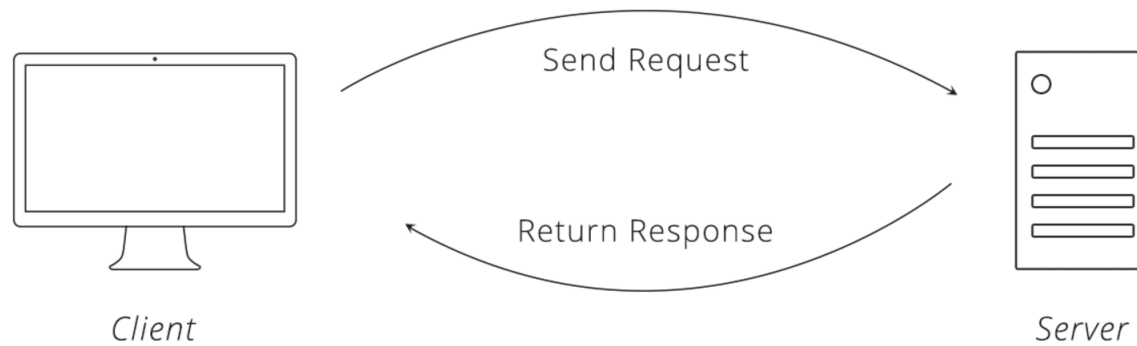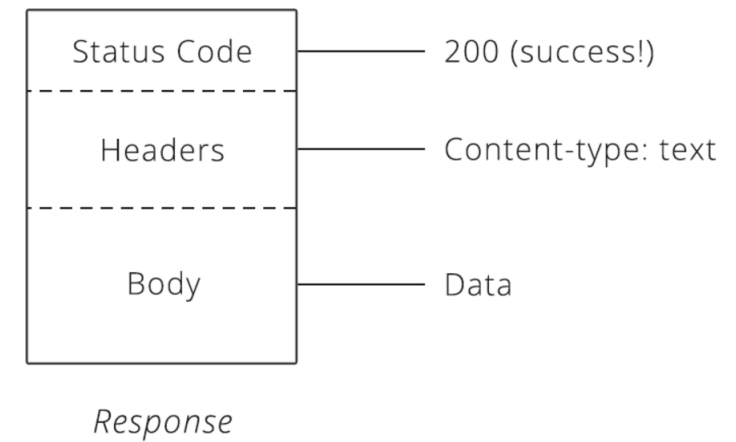- **Client:** A program that exchanges data with a server through an API

Request

Figure 1. The Request-Response Cycle.

To make a valid request, the client needs to include four things:

1. **URL** (Uniform Resource Locator) [1]

2. **Method**

3. List of **Headers**

4. **Body**

Response

Representing Data

The most common formats found in modern APIs
are JSON (JavaScript Object Notation) and XML (Extensible
Markup Language).

```json
{
  "crust": "original",
  "toppings": ["cheese", "pepperoni", "garlic"],
  "status": "cooking",
  "customer": {
    "name": "Brian",
    "phone": "573-111-1111"
  }
}
```

```xml
<order>
    <crust>original</crust>
    <toppings>
        <topping>cheese</topping>
        <topping>pepperoni</topping>
        <topping>garlic</topping>
    </toppings>
    <status>cooking</status>
</order>
```

Authentication

Basic Authorization
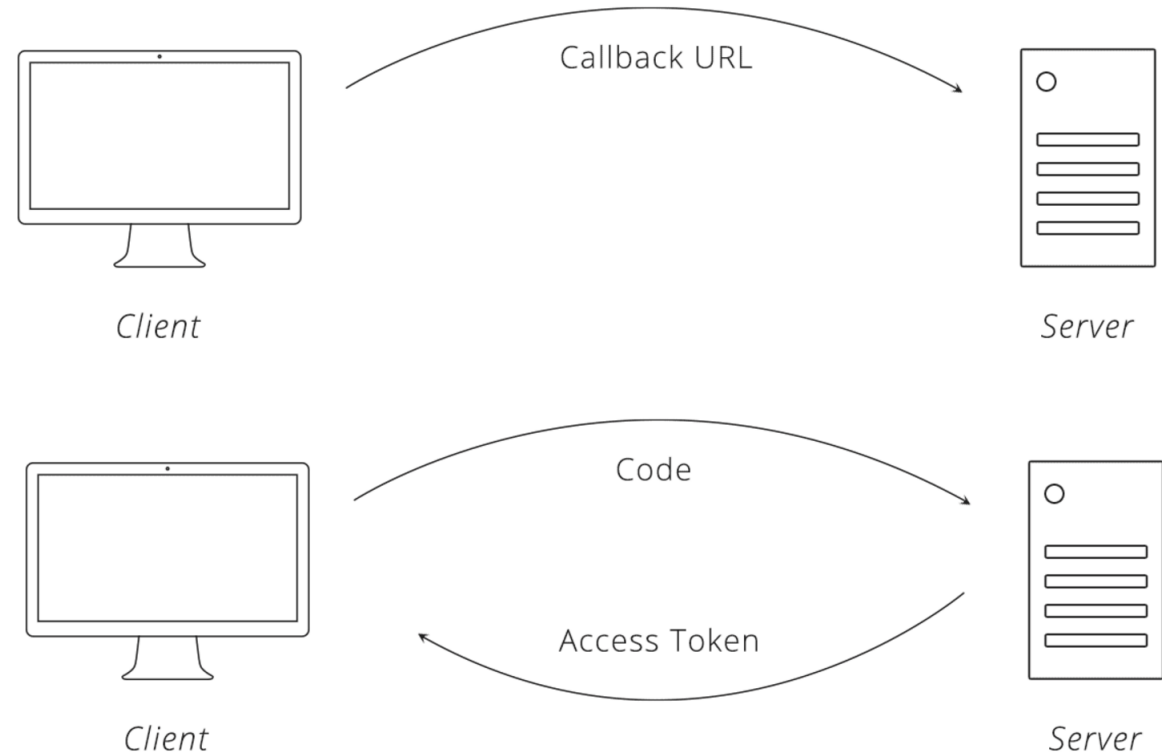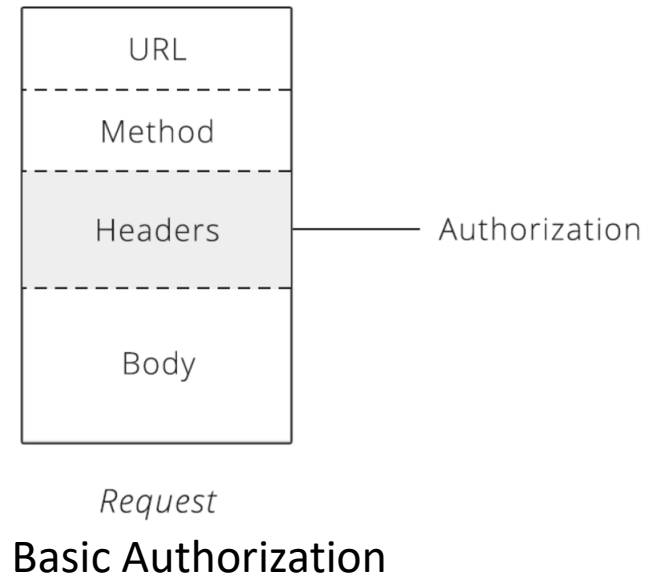
Open Authorization

Request

```
>>> r = requests.get('https://api.github.com/user', auth=('user', 'pass'))
>>> r.status_code
200
>>> r.headers['content-type']
'application/json; charset=utf8'
>>> r.encoding
'utf-8'
>>> r.text
u'{"type":"User"...'
>>> r.json()
{u'private_gists': 419, u'total_private_repos': 77, ...}
```

What is JSON?

- JSON stands for JavaScript Object Notation
- JSON is a lightweight data-interchange format
- JSON is language independent *
- JSON is "self-describing" and easy to understand

JSON Example

```
{"employees":[
    {"firstName":"John", "lastName":"Doe"},
    {"firstName":"Anna", "lastName":"Smith"},
    {"firstName":"Peter", "lastName":"Jones"}
]}
```

JSON Syntax Rules

- Data is in name/value pairs
- Data is separated by commas
- Curly braces hold objects
- Square brackets hold arrays

Example

```
employees[0].firstName = "Gilbert";
```

Try it Yourself »

Example

```
employees[0]["firstName"] = "Gilbert";
```

Try it Yourself »

Default Notice, What does it mean?

- The type of agreement;
- The agreement terms that have been broken;
- What you should do to put the account in order (how much you need to pay and by when);
- What the creditor will do if you don't comply with the request;
- How long you have to respond (this should be a minimum of 14 days);

Homework

- Request current listings by using Lending Club API;
  (if you don't have a SSN, ask help from the TA)

- Organize the data into data frame;

- Download the historical data from Lending Club website;

- Data exploration and data preparation;

* Ask some (3?) questions you think that might be interesting and try to answer them.

* Build a baseline model (binary classification), beware of not including the feature not in the current listing.