

# Python for Good

## »»» PyCon China 2022

### Python分析alpha vaults策略

主讲人：代少飞 — 量化开发



# 个人简介

主要从事量化开发相关工作

有开发过数字货币交易所

PyconChina2019深圳场有分享(b站有相关视频)

目前从事web3相关工作

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### WETH/USDT

 [uniswap\\_v3:view\\_pool](#) →

#### 30\_day\_prices



#### liquidity\_distribution



#### v/r\_ratio\_30d

0.094



#### reserves\_30d

\$148,192,194.51



#### volume\_30d

\$13,884,858.18



#### price\_divergence\_30d

29.396%



#### price0\_30d

\$2,450.19



#### pricel\_30d

\$1.00



position\_assets\_value\_

\$19,303,879.08

apr\_

108.71%

pool\_pnl\_

481,332.38 USD

total\_pnl\_

481,183.10 USD

limit\_prices\_

2416.349400 - 2998.904500

current\_prices\_

2451.1644 WETH/USDT

WETH/USDT

0.000333 - 0.000414 USDT/WETH

0.0004 USDT/WETH

current\_assets\_

WETH 7,333.3974

gas\_costs\_

ETH 0.060925 (\$149.28)

USDT 1,335,562.6265

total\_fees\_

WETH 98.193867 (\$240,593.89)

invested\_assets\_

WETH 7,825.9176

USDT 249,905.770010

USDT 138,047.5393

(\$249,920.79)

withdrawn\_

WETH 0.0000

unclaimed\_fees\_

WETH 3.194098 (\$7,826.16)

USDT 0.0000

USDT 11,775.839820 (\$11,776.55)

diffs\_

WETH -492.5202

collected\_fees\_

WETH 94.999768 (\$232,767.73)

USDT 1,197,515.0872

USDT 238,129.930190

position\_age\_

8.6 days

(\$238,144.24)

fee\_tier

0.30%

nft\_id\_

40558

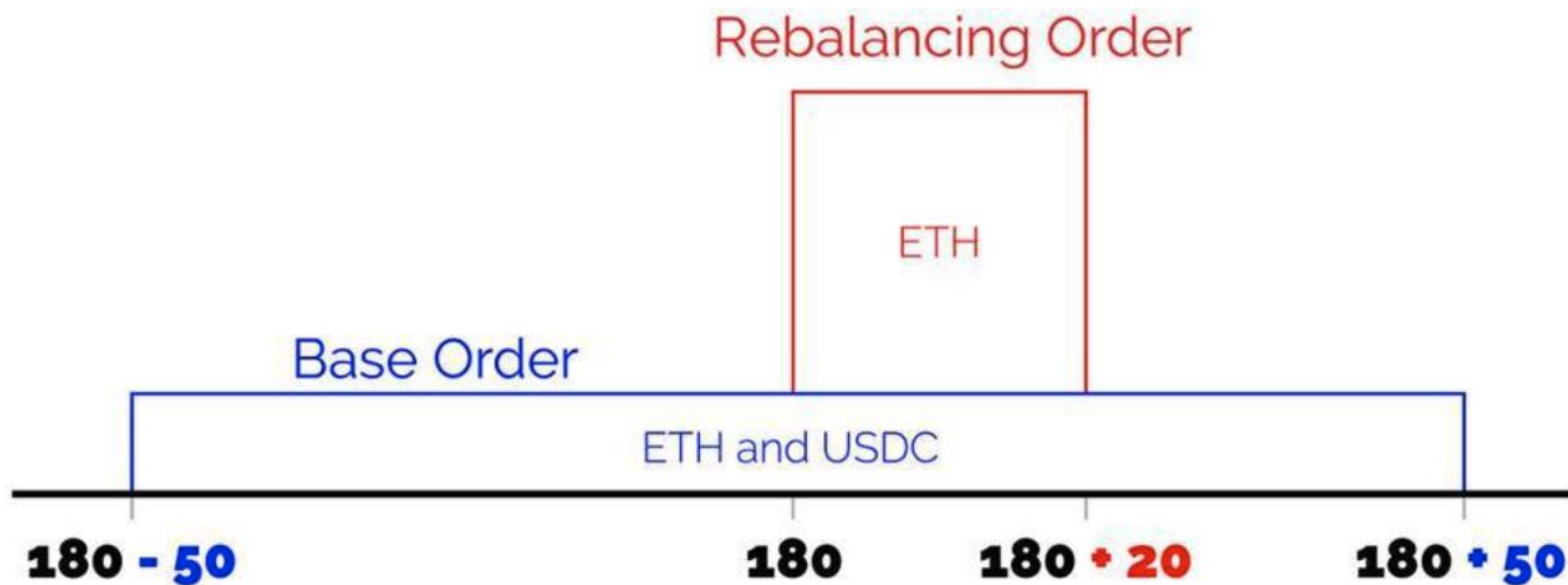
- 一、策略介绍
- 二、部署开发
- 三、使用说明
- 四、策略回测



资金量有一定规模，进出中心化交易所，比较费力

第一个上线的 Uniswap v3 LP 策略

Uniswap v3 在 2021 年 5 月 5 日发布后两天，Charm 部署了其第三款产品：Uniswap v3 LP 操作策略——Alpha Vault，并且已经被证明是非常成功的产品：利润比 v2 的 LP 高两倍以上！



放入uniswap v3池子提供流动性，但是当价格上涨或者下跌时，同样也有无常损失  
初始池子放入 50% ETH和 50% USDC 价格下降，ETH有结余，  
以高于当前价格的区间值投入ETH，冲抵部分无常损失  
通过提供流动性自然地发生转换，不花手续费，甚至还可以赚取交易费

```
DECIMALS = 10 ** 9
X: int = 100_000 * DECIMALS
Y: int = 100_000 * DECIMALS
INVARIANT: int = X * Y

def x_to_y(x_amount: int) -> int:
    """
    It converts x into y.
    """
    global X
    global Y
    global INVARIANT
    new_x = X + x_amount
    new_y = INVARIANT // new_x

    out_tokens = Y - new_y
    X = new_x
    Y = new_y
    INVARIANT = X * Y
    return out_tokens
```

```
print(f"X: {X / DECIMALS} Y: {Y / DECIMALS}")

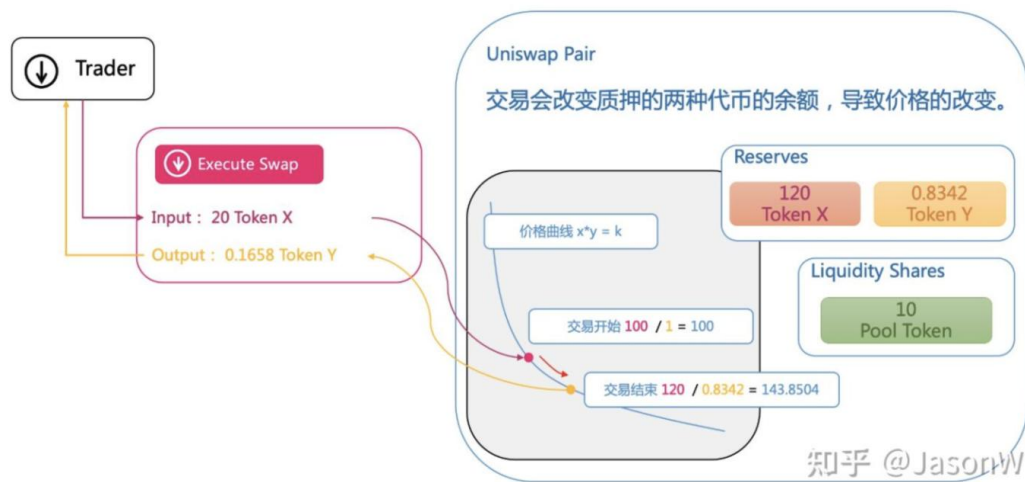
print('Alice exchange 50 x tokens in y.')
out_tokens = x_to_y(50 * DECIMALS)
print("Y Tokens she'll get: ", out_tokens / DECIMALS)
print(f"X: {X / DECIMALS} Y: {Y / DECIMALS}")

print('Bob exchange 50 x tokens in y.')
out_tokens = x_to_y(50 * DECIMALS)
print("Y Tokens Bob will get: ", out_tokens / DECIMALS)
print(f"X: {X / DECIMALS} Y: {Y / DECIMALS}")

print('Alice exchange 50 x tokens in y.')
out_tokens = x_to_y(50 * DECIMALS)
print("Y Tokens she'll get: ", out_tokens / DECIMALS)
print(f"X: {X / DECIMALS} Y: {Y / DECIMALS}")
```

```
X: 100000.0 Y: 100000.0
Alice exchange 50 x tokens in y.
Y Tokens she'll get: 49.975012494
X: 100050.0 Y: 99950.024987506
Bob exchange 50 x tokens in y.
Y Tokens Bob will get: 49.925087407
X: 100100.0 Y: 99900.0999000099
Alice exchange 50 x tokens in y.
Y Tokens she'll get: 49.875237095
X: 100150.0 Y: 99850.224663004
```





如上图所示，原流动性池中两种代币余额为100 X和1 Y，可认为Y相对X的价格为1 Y = 100 X，此时要通过流动性池交易20个X，如果按照当前价格全量交易的话，应该换回  $20 / 100 = 0.2$  个Y，再减去0.3%的手续费，最后返回0.1994个Y，但实际返回了0.1658个Y，我们来逐步分析一下：

1. 输入20个X，先扣除0.3%的手续费，即实际交易量为19.94个X；
2. 按照 $x*y=k$  ( $k=1*100=100$ ) 的公式进行计算：

$$(100 + 19.94) \times (1 - \Delta y) = 100$$

$$\Delta y \approx 0.1658$$

3. Uniswap pair会给交易者地址返回0.1658个Y，此交易平均交易价格为  $1 Y = 20 / 0.1658 X = 120.6273 X$ ，比交易开始时的100要高20%多，主要是因为交易量20个X相对于流动性池的比例较大（20%），相当于大额交易，对价格会产生较大影响，直观的感觉就是市场上有人大量买入Y，从而导致Y的价格上涨，此笔交易之后，交易池中Y相对于X的价格变为了143.8504；

## Brownie

Brownie is a Python-based development and testing framework for smart contracts targeting the Ethereum Virtual Machine.

## FastAPI

FastAPI is a modern, fast (high-performance), web framework for building APIs with Python 3.7+ based on standard Python type hints.

## web3.py

A Python library for interacting with Ethereum, inspired by web3.js  
code

<https://github.com/charmfinance/alpha-vaults-contracts.git>

```
pip install eth-brownie
```

```
git clone https://github.com/charmfinance/alpha-vaults-contracts.git  
cd alpha-vaults-contracts
```

```
brownie pm install Uniswap/uniswap-v3-periphery@1.0.0  
brownie pm clone Uniswap/uniswap-v3-periphery@1.0.0
```

```
#import account by private key  
brownie accounts new deployer  
Enter the private key you wish to add: CEC8B042507730E92DC09A08AF4EDD2AA3D893CD34D187CBE4E708D370\*\*\*\*\*  
Enter the password to encrypt this account with:  
SUCCESS: A new account '0xe8D083537d89EfC362D7fC84e023cc22169e68FB' has been generated with the id 'deployer'
```

```
export WEB3_INFURA_PROJECT_ID=745c8928dc934545a1056b325e1\*\*\*\*\*  
export ETHERSCAN_TOKEN=YM1XSQ331HZD62TK6PW4IZDRVINND\*\*\*\*\*
```

```
alpha-vaults-contracts/scripts/deploy_rinkeby.py  
# Uniswap v3 factory on Rinkeby  
# FACTORY = "0xAE28628c0fdFb5e54d60FEDC6C9085199aec14dF"  
FACTORY = "0x1F98431c8aD98523631AE4a59f267346ea31F984"
```

```
#自动编译合约  
brownie run deploy\_rinkeby --network rinkeby  
# Vault address: 0xb30E17bAB45d814a449caFCC45167d72b6569D0B  
# Strategy address: 0xAc9AcD08c7D034EfCfF29F3AB5582E4d317071B0  
# Router address: 0xFaB03db5445b9d17931046AE3065A802A77DC4F3
```

```
#修改为部署的合约  
alpha-vaults-contracts/scripts/rebalance.py  
STRATEGIES = [  
    # "0x40C36799490042b31EfC4D3A7F8BDe5D3cB03526",  
    '0xAc9AcD08c7D034EfCfF29F3AB5582E4d317071B0'  
]  
]
```

```
#调试使用方法
brownie console --network rinkeby

from brownie import project
FACTORY = "0x1F98431c8aD98523631AE4a59f267346ea31F984"
UniswapV3Core = project.load("Uniswap/uniswap-v3-core@1.0.0")
eth = '0x56D54822B555D499B8D10c24cDcbd56ED6D7F4Ed'
usdc = '0xFc96988ae4866a1391767e80D2930352dfdf4351'
factory = UniswapV3Core.interface.IUniswapV3Factory(FACTORY)
pool = UniswapV3Core.interface.IUniswapV3Pool(factory.getPool(eth, usdc, 3000))

def some_func():
    pass

import uvicorn
from fastapi import FastAPI
app = FastAPI()
uvicorn.run(app, host="0.0.0.0", port=8000)
```



# 使用说明

## 拿一次实际调整举例说明

该例子为估算值, 实际有手续费等, 造成差异

2021-06-23 05:30 调整时

当时价格

$p_0 = 1900$

大区间 (通常为base\_price\_percent 43.75%)  $(2740 - p_0) / p_0$

1326 - 2740

小区间 (通常为limit\_price\_percent 12.76%)  $(2156 - p_0) / p_0$

1912 - 2156

价差 gap0: 12.76%

价差四分之一 gap0\_alter:  $12.76\% / 4 = 3.19\%$

2021-06-23 17:30 调整时

当时价格

$p_1 = 1995$

大区间

1391 - 2875

小区间

2006 - 2262

调仓频次

每12小时

调仓条件(简化版)

当时价格百分比  $p\_gap = (p_1 - p_0) / p_0 = 5\%$

$p\_gap > gap0\_alter$  触发调仓

价格调整

大区间 (通常为base\_price\_percent 43.75%)

小区间 (通常为limit\_price\_percent 12.76%)

下单数量

当时价格 1995

总量

eth: 114.65

usdt: 222530.63

大区间 1:1

eth: 112.7

usdt: 222530.63

价格

$1391 = 1995 / (1 + 0.4375)$

$2875 = 1995 * (1 + 0.4375)$

小区间(只有eth, 单挂)

eth: 1.97

usdt: 0

价格

2006 (1995 tick转换, tickspacing误差)

2262  $(1995 * (1 + 0.1276))$



### 具体使用说明

rebalance

访问地址:

`http://8.211.165.*:8000/get_av_args_by_price?base_price_percent=43.75&limit_price_percent=12.76&amount0=114.65&amount1=222530.63`

入参

`base_price_percent`: 大区间(当前价和最大值百分比)

`limit_price_percent`: 小区间(价差百分比)

`amount0`: 为eth 数量

`amount1`: 为usdt 数量 或者uni link (uni link支持待测试)

出参

`base`为大区间, `limit`为小区间 `amount`为数量0为eth, 1为usdt, `price`为价格, `l,u` 为上下沿

```
{
```

```
  "base_amount0": 109.45333015976345,
```

```
  "base_amount1": 222530.63,
```

```
  "base_price_l": 1414.3706318831737,
```

```
  "base_price_u": 2922.5261479682144,
```

```
  "limit_amount0": 5.196669840236544,
```

```
  "limit_amount1": 0,
```

```
  "limit_price_l": 2033.1097251739516,
```

```
  "limit_price_u": 2292.540292164349
```

```
}
```

判断是否调仓

[http://8.211.165.\\*:8000/manual\\_rebalance?last\\_price=1900](http://8.211.165.*:8000/manual_rebalance?last_price=1900)

入参

`last_price` 为上一次调整的值

说明:

默认 `gap0_alter` 为 3.19% (看事例说明)

出参

`true` 为应该调整

`false` 为不应该调整

原理:

统计一段时间每小时呆在价格区间的命中率, 暂时不考虑小时流动性

区间下沿价格 $p_l$

区间上沿价格 $p_u$

选取每小时平均值 $p$ 作为参考, 区间命中率  $(100/\max(p-p_l, p_u-p))$ , 在求和

如果不在区间就为0, 不计入

时间范围

2021-06-15 09:00:00 到 2021-06-17 10:00:00

币对

eth/usdt

对比对象

Alpha

<https://alpha.charm.fi/vault/ETH/USDT>

账号 0xae540be685696ea465b12bbdf9e5f44603bb9ab2

<https://revert.finance/#/uniswap-position/40558>

<https://revert.finance/#/account/0xae540be685696ea465b12bbdf9e5f44603bb9ab2>

结果值 值越大，命中率越高

Alpha Valuts


3.865960084033544

0xae540be685696ea465b12bbdf9e5f44603bb9ab2

7.536748535889405

该账号为一些账户中处于中等以上水平盈利

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0.0004 USDT/WETH

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ETH 0.060925 (\$149.28)

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WETH 7,333.3974

USDT 1,335,562.6265

total\_fees\_

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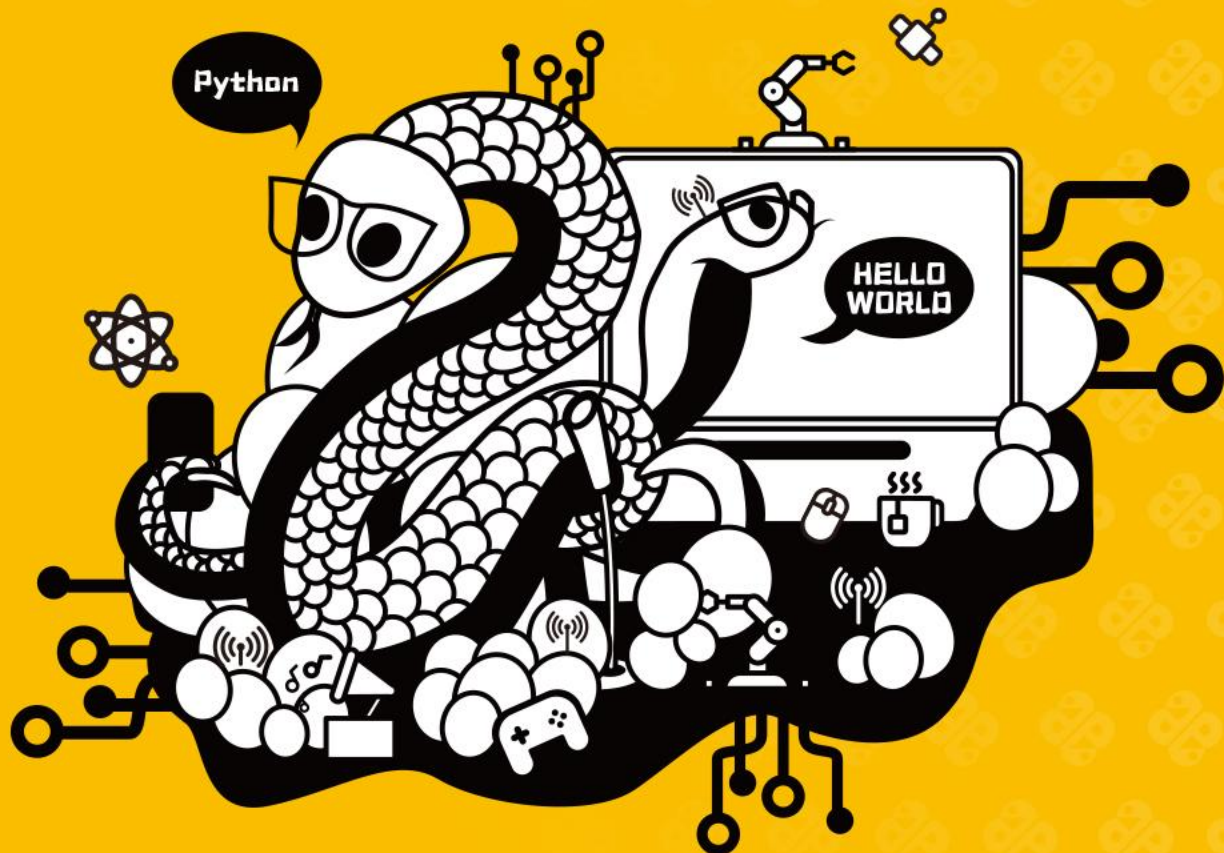
fee\_tier

0.30%

nft\_id\_

40558





Ghoti

广东 深圳



扫一扫上面的二维码图案，加我为朋友。