# 文档说明

1. 读取数据：

读取药品的所有记录，对于缺少的数据，通过计算已有数据的平均值进行补值。

1. 预处理：

求得每种药品记录的最大值，选取最大值大于30的药品。对于已经选出的药品，选取所有县中使用该药品的年变化率较大的或使用量较大的若干县，绘制这些县的该药品使用量的散点图。图中横坐标表示从2009年距记录年份的差值，纵坐标表示药品使用量记录。

1. 拟合：

对于｛'Benzylfentanyl', 'Methoxyacetyl fentanyl', 'Cyclopropyl fentanyl', 'Fluoroisobutyryl fentanyl', 'Butyryl fentanyl', 'Acryl fentanyl', '3-Methylfentanyl', '4-Fluoroisobutyryl fentanyl', 'Acetyl fentanyl', 'ANPP', 'Carfentanil', 'Codeine', 'Fentanyl', 'Fluoroisobutyryl fentanyl', 'Furanyl fentanyl', 'Mitragynine', 'Tramadol', 'U-47700'｝这些药品的使用量散点图，使用二次多项式拟合，其他药品则使用指数式进行拟合，然后绘制拟合曲线。

1. 绘制阈值线：

对于每个药物绘制的图像中的各个县，这些县的记录的最大值中的中位数作为阈值，然后绘制这条阈值线

1. 找出五个州中可能已经开始使用特定阿片类药物的任何可能位置：

对于每个药物绘制的图像，如果图中某个县的记录的离散点在阈值线以上，则说明该县可能已经开始使用该阿片类药物

|  |  |  |
| --- | --- | --- |
| 阿片类药物 | 州 | 县 |
| Morphine | PA | PHILADEPHIA |
| DELAWARE |
| OH | HAMILTON |
| FRANKLIN |
| MONTGOMER |
| Methadone | OH | MONTGOMERY |
| HAMILTON |
| KY | JEFFERSON |
| PERRY |
| HARLAN |
| PA | PHILADELPHIA |
| Heroin | PA | PHILADELPHIA |
| ALLEGHENY |
| OH | HAMILTON |
| Hydromorphone | WV | MERCER |
| SUMMERS |
| VA | TAZEWELL |
| WARREN |
| Oxycodone | PA | PHILADELPHIA |
| OH | FRANKLIN |
| HAMILTON |
| Oxymorphone | KY | JEFFERSON |
| BULLITT |
| PA | ALLEGHENY |
| OH | GALLIA |
| Buprenorphine | PA | PHILADELPHIA |
| ALLEGHENY |
| OH | HAMILTON |
| FRANKLIN |
| VA | TAZEWELL |
| Hydrocodone | KY | JEFFERSON |
| PA | ALLEGHENY |
| OH | MONTGOMERY |
| Fentanyl | OH | HAMILTON |
| CUYAHOGA |
| PA | PHILADELPHIA |
| Codeine | OH | CUYAHOGA |
| HAMILTON |
| PA | PHILADELPHIA |
| Tramadol | OH | MAHONING |
| CUYAHOGA |
| PA | PHILADELPHIA |
| ANPP | OH | CUYAHOGA |
| LAKE |
| Mitragynine | OH | MONTGOMERY |
| JEFFERSON |
| CUYAHOGA |
| Acetyl fentanyl | OH | HAMILTON |
| CUYAHOGA |
| PA | PHILADELPHIA |
| Butyryl fentanyl | OH | HAMILTON |
| PA | ALLEGHENY |
| CUYAHOGA |
| Furanyl fentanyl | OH | MONTGOMERY |
| HAMILTON |
| Carfentanil | OH | CUYAHOGA |
| MONTGOMERY |
| Acryl fentanyl | OH | MONTGOMERY |
| CUYAHOGA |
| U-47700 | OH | HAMILTON |
| CUYAHOGA |
| 3-Methylfentanyl | OH | LORAIN |
| ERIE |
| 4-Fluoroisobutyryl fentanyl | PA | ALLEGHENY |
| VA | HENRICO |
| Fluoroisobutyryl fentanyl | OH | CUYAHOGA |
| HAMILTON |
| Cyclopropyl fentanyl | OH | HAMILTON |
| FRANKLIN |
| Methoxyacetyl fentanyl | OH | HAMILTON |
| CUYAHOGA |
| Benzylfentanyl | OH | CUYAHOGA |
| PA | ALLEGHENY |

1. 模型预测它们将在何时何地发生：

对于每个药物绘制的图像，如果图中某条拟合曲线在x=8之后与阈值线存在交点，则说明在该拟合曲线所代表的县将发生这些情况，发生时间为

|  |  |  |  |
| --- | --- | --- | --- |
| 阿片类药物 | 州 | 县 | 时间 |
| Morphine | PA | DELAWARE | 2018 |
| OH | CUYAHOGA | 2020 |
| Methadone | None | | |
| Heroin | OH | CUYAHOGA | 2019 |
| Hydromorphone | None | | |
| Oxycodone | OH | CUYAHOGA | 2022 |
| Oxymorphone | VA | SPOTSYLANIA | 2019 |
| Buprenorphine | OH | HAMILTON | 2019 |
| PA | DELAWARE | 2019 |
| KY | BELL | 2021 |
| Hydrocodone | None | | |
| Fentanyl | OH | MONTGOMERY | 2018 |
| PA | ALLEGHENY | 2018 |
| Codeine | OH | FRANKLIN | 2018 |
| STARK | 2019 |
| Tramadol | OH | HAMILTON | 2018 |
| ANPP | OH | SUMMIT | 2019 |
| KY | FAYETTE | 2023 |
| Mitragynine | OH | LAKE | 2027 |
| Acetyl fentanyl | PA | ALLEGHENY | 2021 |
| Butyryl fentanyl | PA | WASHINGTON | 2020 |
| Furanyl fentanyl | PA | ALLEGHENY | 2018 |
| OH | CUYAHOGA | 2019 |
| Carfentanil | OH | HAMILTON | 2018 |
| LAKE | 2020 |
| Acryl fentanyl | OH | LAKE | 2021 |
| GREENE | 2022 |
| U-47700 | PA | ALLEGHENY | 2019 |
| OH | STARK | 2020 |
| 3-Methylfentanyl | PA | DELAWARE | 2018 |
| OH | CUYAHOGA | 2018 |
| 4-Fluoroisobutyryl fentanyl | VA | CHESTERFIELD | 2018 |
| FAIRFAX | 2018 |
| Fluoroisobutyryl fentanyl | OH | BUTLER | 2018 |
| VA | FAIRFAX | 2018 |
| PA | DAUPHIN | 2018 |
| LUZERNE | 2018 |
| Cyclopropyl fentanyl | PA | ALLEGHENY | 2019 |
| OH | CUYAHOGA | 2020 |
| Methoxyacetyl fentanyl | PA | ALLEGHENY | 2018 |
| OH | LAKE | 2024 |
| Benzylfentanyl | OH | LAKE | 2019 |
| BUTLER | 2021 |