Analysis of Filtration Efficiency of different materials

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Data Access

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## # A tibble: 6 x 11
##   X1                X2    X3    X4    X5    X6    X7    X8    X9    X10   X11
##   <chr>             <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr> <chr>
## 1 Shirting Cotton   Test~ Test~ Test~ Test~ Test~ Test~ Test~ Test~ Test~ Test~
## 2 Upstream          1060  1100  1040  995   1010  1050  1070  1050  1020  1050
## 3 Downstream        722   749   729   676   665   694   703   666   657   676
## 4 Lightweight Cotton Test~ Test~ Test~ Test~ Test~ Test~ Test~ Test~ Test~ Test~
## 5 Upstream          1030  986   967   953   936   995   990   1010  1020  1020
## 6 Downstream        692   670   672   659   648   695   707   720   723   730
```

The research question of the project is find the most efficient filter fabric or mask. And when tested under standardized conditions, how efficient is the filtration of each test object?

Data Wrangling

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##
##
## Table: Filtration Efficiency in Each Test
##
## |   |Product                | Test 1| Test 2| Test 3| Test 4| Test 5| Test 6| Test 7| Test 8| Test 9
## |:--|:----------------------|------:|------:|------:|------:|------:|------:|------:|------:|------:
## |1  |Shirting Cotton        | 0.3189| 0.3191| 0.2990| 0.3206| 0.3416| 0.3390| 0.3430| 0.3657| 0.3559
## |3  |Lightweight Cotton     | 0.3282| 0.3205| 0.3051| 0.3085| 0.3077| 0.3015| 0.2859| 0.2871| 0.2912
## |5  |Quilting Cotton        | 0.3421| 0.2915| 0.3577| 0.3584| 0.3508| 0.3434| 0.3581| 0.3466| 0.3414
## |7  |Fusible Interfacing    | 0.1247| 0.1429| 0.1798| 0.1583| 0.1395| 0.1466| 0.1512| 0.1333| 0.1523
## |9  |Cotton Flannel         | 0.3087| 0.3069| 0.2901| 0.2610| 0.2771| 0.2937| 0.2701| 0.2851| 0.2818
## |11 |Cotton Quilt Batting   | 0.2687| 0.3086| 0.3021| 0.3016| 0.2880| 0.2971| 0.2948| 0.3059| 0.2994
## |13 |Jeans Denim            | 0.5175| 0.4652| 0.4592| 0.4571| 0.4434| 0.4535| 0.4423| 0.4517| 0.4589
## |15 |Lycra                  | 0.2030| 0.1860| 0.2171| 0.2105| 0.2074| 0.2214| 0.2239| 0.2248| 0.2383
## |17 |Two Sided Minky Fabric | 0.3452| 0.3448| 0.3411| 0.3333| 0.3393| 0.3304| 0.3430| 0.3360| 0.3522
## |19 |3M n95 mask            | 0.5238| 0.4826| 0.5115| 0.5441| 0.4941| 0.5248| 0.5426| 0.5378| 0.5465
## |21 |Surgical Mask          | 0.4773| 0.4723| 0.4793| 0.4946| 0.4836| 0.4677| 0.4806| 0.4710| 0.4595
## |23 |3m Dust Mask           | 0.5669| 0.5794| 0.5718| 0.5695| 0.5812| 0.5870| 0.5752| 0.5866| 0.5961
```

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##
##
## Table: Average Filtration Efficiency
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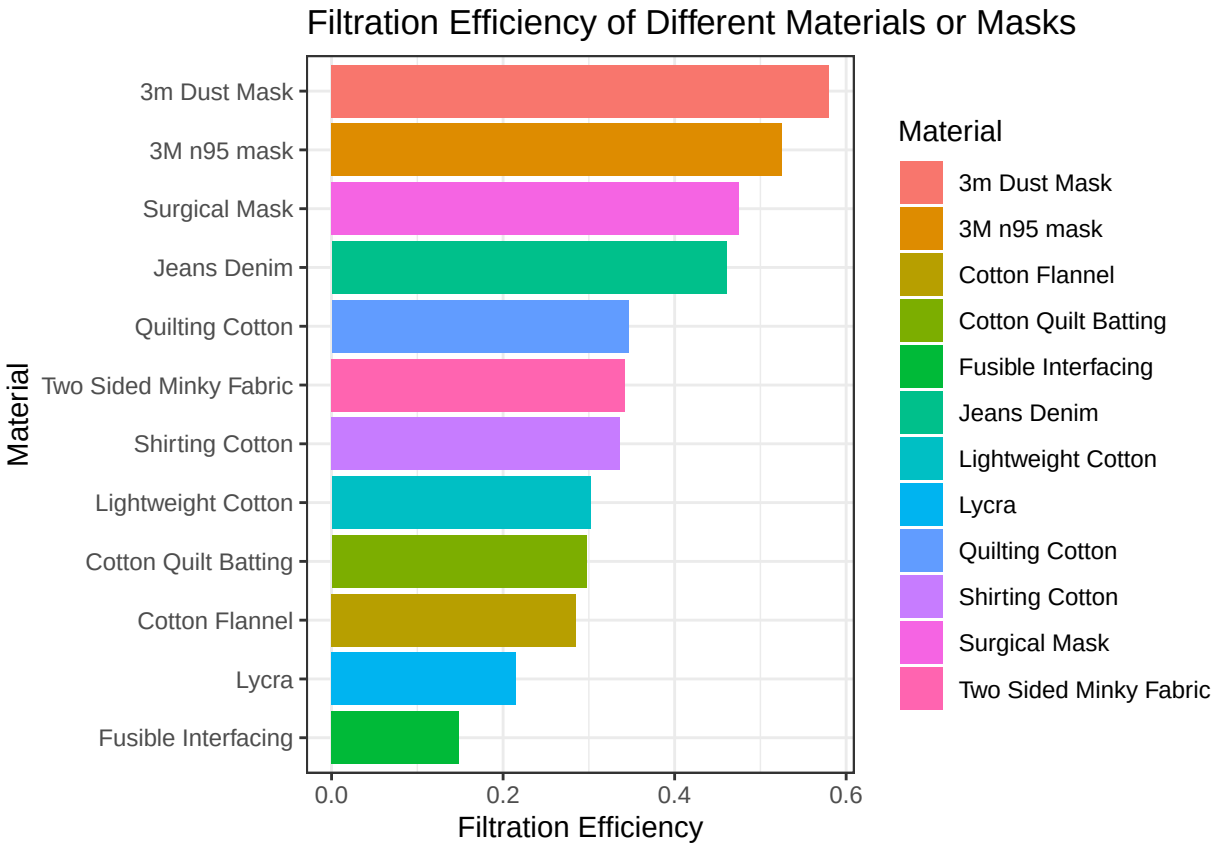
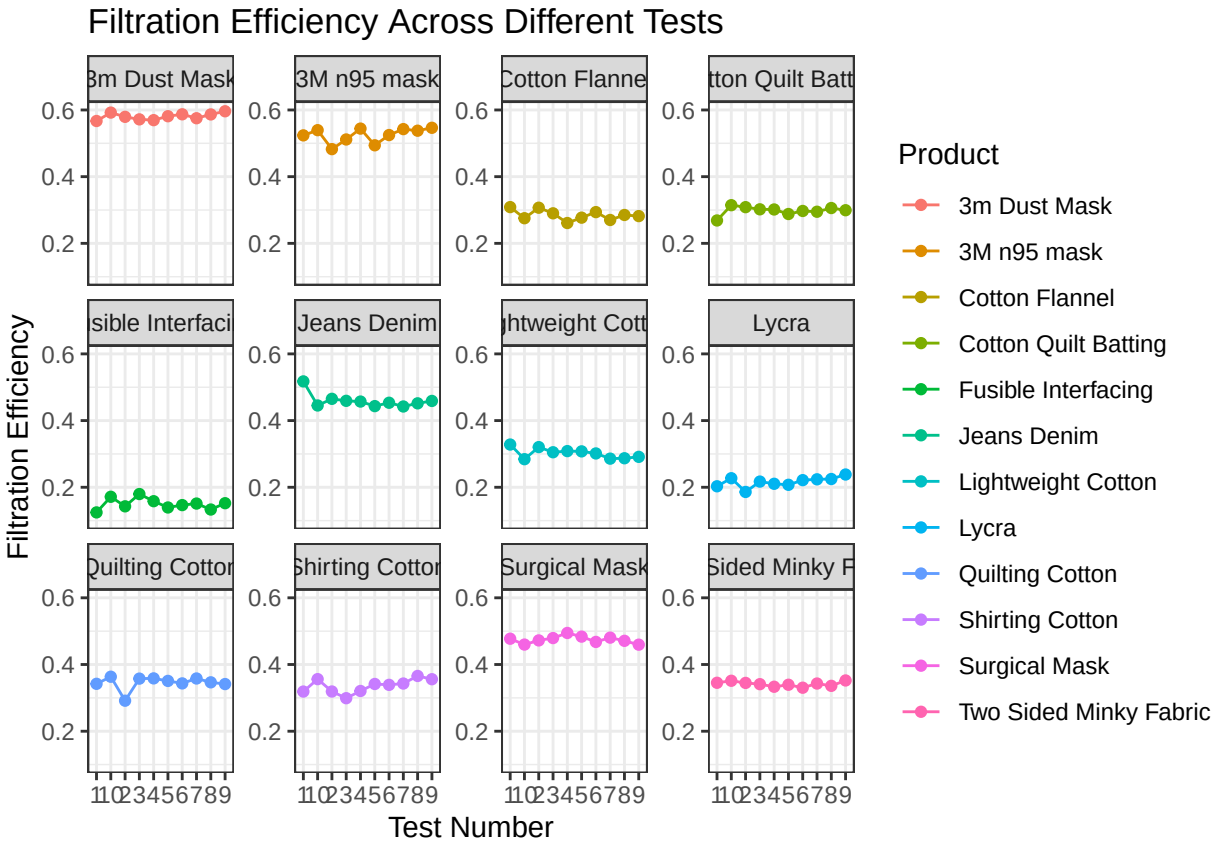
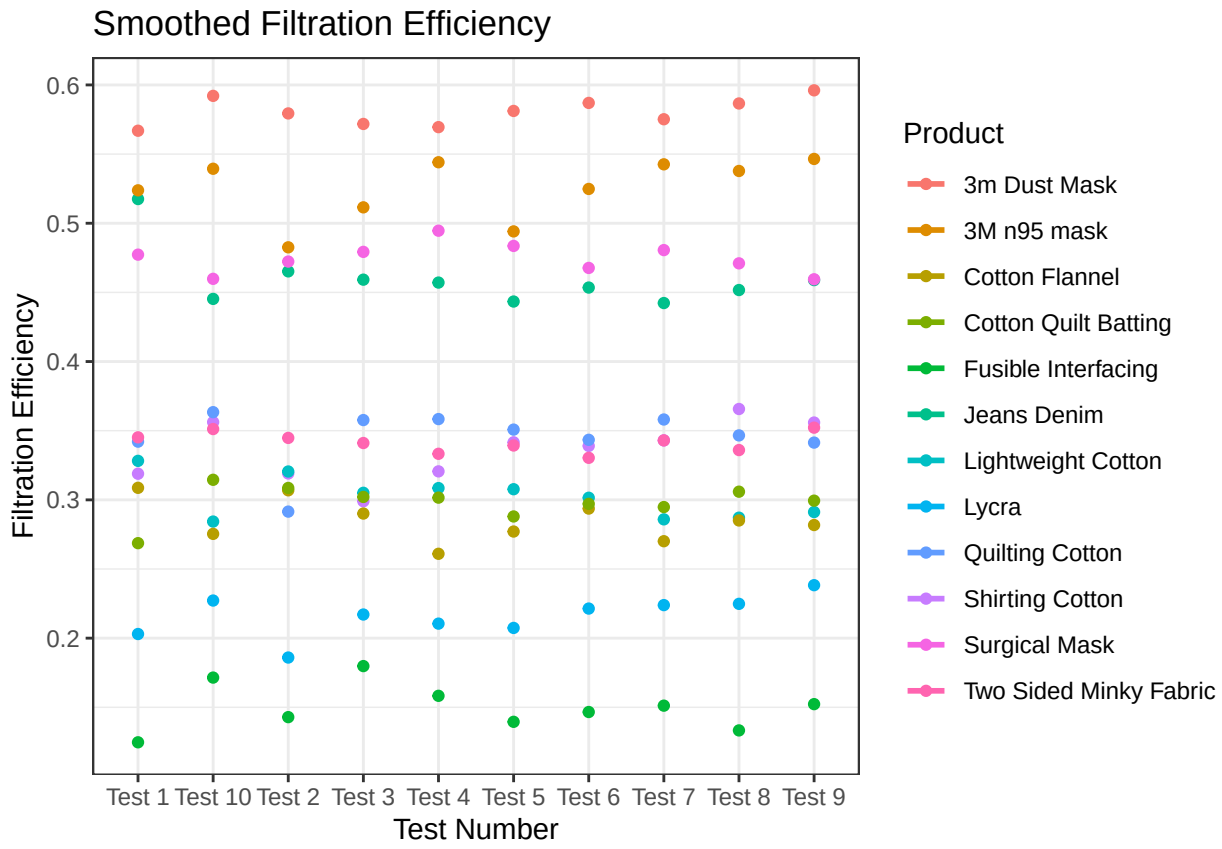
## |Product                | Efficiency|
## |:----------------------|----------:|
## |3m Dust Mask           |     0.5803|
## |3M n95 mask            |     0.5253|
## |Surgical Mask          |     0.4748|
## |Jeans Denim            |     0.4604|
## |Quilting Cotton        |     0.3462|
## |Two Sided Minky Fabric |     0.3417|
## |Shirting Cotton        |     0.3359|
## |Lightweight Cotton     |     0.3019|
## |Cotton Quilt Batting   |     0.2973|
## |Cotton Flannel         |     0.2848|
## |Lycra                  |     0.2155|
## |Fusible Interfacing    |     0.1490|
```

There are 10 tests for each materials in total, the first table shows the filtration efficiency of different materials in each test. The second table shows the filtration efficiency of different materials from high to low. From Average Filtration Efficiency table, it is easy to see the 3m Dust Mask has the highest FE among masks, the Jeans Denim has the highest Fe among fabrics.

Data Visualization




Filtration Efficiency Across Different Tests
3m Dust Mask
3M n95 mask
Cotton Flanne
tton Quilt Batt
sible Interfaci
Jeans Denim
ghtweight Cott
Lycra
Quilting Cotton
Shirting Cotton
Surgical Mask
Sided Minky F
Filtration Efficiency
0.2
0.4
0.6
1 1 0 2 3 4 5 6 7 8 9
Test Number
Product
3m Dust Mask
3M n95 mask
Cotton Flannel
Cotton Quilt Batting
Fusible Interfacing
Jeans Denim
Lightweight Cotton
Lycra
Quilting Cotton
Shirting Cotton
Surgical Mask
Two Sided Minky Fabric



According to the visualization, we can find out 3m Dust Mask not only has the highest FE, also very stable during the tests. While the result in test 1 of Jeans Denim is significantly greater than that of the rest of the tests. In conclusion, different types of masks have good filtration efficiency, especially 3m Dusk Mask. And in situations where no mask can be used, such as a fire, Jeans Denim can be used as a temporary alternative because of its filtration efficiency that is no less than that of a medical mask.