HW4

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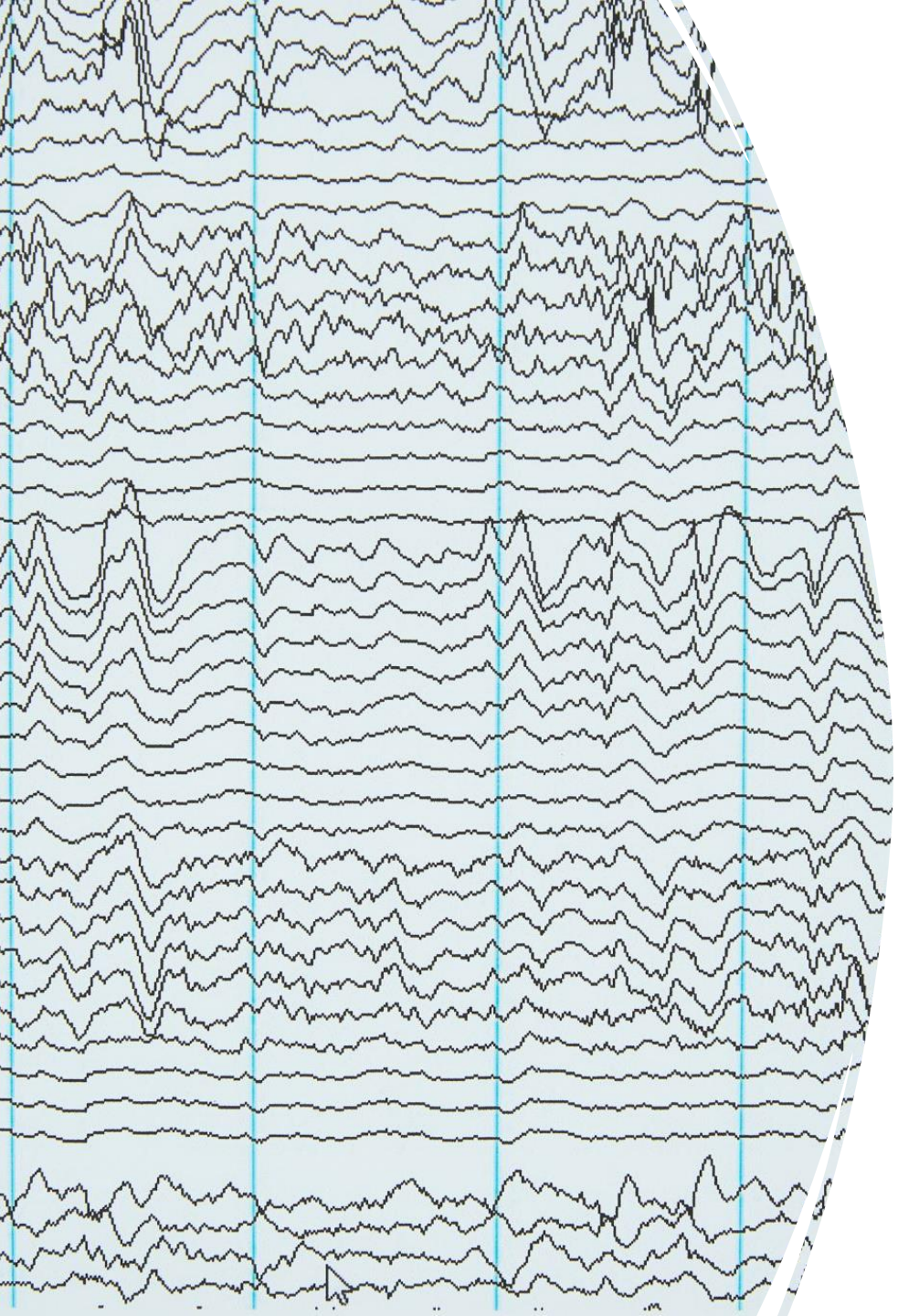
JT393



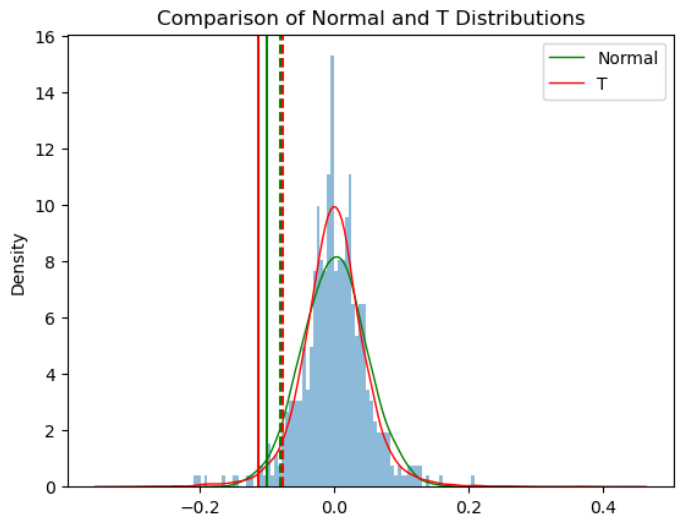
Problem 1

- Use the data in problem1.csv. Fit a Normal Distribution and a Generalized T distribution to this data. Calculate the VaR and ES for both fitted distributions.
- Overlay the graphs the distribution PDFs, VaR, and ES values. What do you notice? Explain the differences.

Problem 1

```
Normal distribution VaR: 0.08030149126100469
T distribution VaR: 0.07635929210300244
Normal distribution ES: 0.10109468580550082
T distribution ES: 0.11380741181899869
```

- **ANS:**
- For T distribution, VaR is smaller than normal distribution, and ES is larger than normal distribution.
- For T distribution, it has fatter tails than normal distribution, which means that there are more extreme values in T distribution. Thus, this is why the ES value of T distribution is larger.



Problem 2

- In your main repository, create a Library for risk management. Create modules, classes, packages, etc as you see fit. Include all the functionality we have discussed so far in class. Make sure it includes
- 1. Covariance estimation techniques.
- 2. Non PSD fixes for correlation matrices
- 3. Simulation Methods
- 4. VaR calculation methods (all discussed)
- 5. ES calculation Create a test suite and show that each function performs as expected.

Problem 2

- Ans:
- I have uploaded my package, called myfunctions, to PyPl. So, now, you can install it by key in “pip install Risk_lib_jt393”.
- I have already tested functions in the package. For details of tests, you can check Jupiter notebook.

Problem 3

- Use your repository from #2.
- Using Portfolio.csv and DailyPrices.csv. Assume the expected return on all stocks is 0.
- This file contains the stock holdings of 3 portfolios. You own each of these portfolios.
- Fit a Generalized T model to each stock and calculate the VaR and ES of each portfolio as well as your total VaR and ES. Compare the results from this to your VaR form Problem 3 from Week 4.

Problem 3

- Hist_var / Hist_es

```
Portfolio A VaR: 18242.436493048866
Portfolio A ES: 25436.032975374277

Portfolio B VaR: 11337.063397132808
Portfolio B ES: 14528.193412533596

Portfolio C VaR: 23752.39753743753
Portfolio C ES: 31623.034028716083

Portfolio Total VaR: 50682.26744043997
Portfolio Total ES: 68296.60420860404
```

- T_dist_var / T_dist _es

```
Portfolio A VaR: 8237.13304917766
Portfolio A ES: 10855.507986431727

Portfolio B VaR: 3953.3260380296765
Portfolio B ES: 5001.904906795368

Portfolio C VaR: 15111.3278466752
Portfolio C ES: 20218.263030389197

Portfolio Total VaR: 18369.34449447067
Portfolio Total ES: 23526.34608256099
```

Problem 3

- Ans:
- For historic data, the result is quite close to the one from week4 question 3.
- The VaR/ES of T distribution simulation is much lower than VaR/ES of historical method.
- The reasons that cause this are t-distribution has fatter tail so that it can better capture extreme events, which could happen in real life.
- Also, the t-distribution has a degrees-of-freedom parameter that allows it to flexibly model the fatness of the tails, providing a better fit to the observed data.
- In conclusion, this simulation may be closer to our real life, because it can take extreme events into account. However, it still has its own limits.