Statistics and Data Analysis
Unit 06 – Lecture 08 Notes

Tofik Ali

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Topic

Time-series diagnostics and SARIMA seasonal modeling (overview).

Learning Outcomes

- Explain why diagnostics are needed after fitting
- Recognize residual autocorrelation as model issue
- Explain SARIMA seasonal terms at a high level
- Choose seasonal period s (weekly/monthly/yearly)

Detailed Notes

These notes are designed to be read alongside the slides. They expand each slide bullet into plain-language explanations, small worked examples, and common pitfalls. When a formula appears, emphasize (1) what each symbol means, (2) the assumptions needed to use it, and (3) how to interpret the final number in the problem context.

Diagnostics

- Residuals should look like white noise
- Check residual ACF
- Check stability of variance

SARIMA

- ARIMA(p,d,q) x (P,D,Q,s)
- Seasonal differencing D
- s is the seasonal period

Exercises (with Solutions)

Exercise 1: Residual goal

After fitting, what should residuals look like ideally?

Solution

- White noise: no pattern, no autocorrelation.

Exercise 2: Seasonal period

Daily data with weekly seasonality: what is s?

Solution

- s=7

Exercise 3: Why seasonal

Why add seasonal terms?

Solution

- To capture repeating seasonal dependence.

Exit Question

What is one residual symptom that suggests your model is inadequate?

Demo (Python)

Run from the lecture folder:

```
python demo/demo.py
```

Output files:

- `images/demo.png`
- `data/results.txt`

References

- Montgomery, D. C., & Runger, G. C. *Applied Statistics and Probability for Engineers*, Wiley.
- Devore, J. L. *Probability and Statistics for Engineering and the Sciences*, Cengage.
- McKinney, W. *Python for Data Analysis*, O'Reilly.