Statistics and Data Analysis
Unit 06 – Lecture 03: AR and MA Models

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https://github.com/tali7c/Statistics-and-Data-Analysis

Quick Links

Overview   AR   MA   Exercises   Demo   Summary

Agenda

Learning Outcomes

- Explain AR(p) model idea

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- Explain AR(p) model idea
- Explain MA(q) model idea

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- Explain AR(p) model idea
- Explain MA(q) model idea
- Differentiate AR vs MA intuition

Learning Outcomes

- Explain AR(p) model idea
- Explain MA(q) model idea
- Differentiate AR vs MA intuition
- Define white noise (basic)

AR: Key Points

- Current value depends on past values

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- AR(1): $x_t = c + \text{phi } x_{t-1} + e_t$

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- Current value depends on past values
- AR(1): $x_t = c + \text{phi } x_{t-1} + e_t$
- Phi controls persistence

AR: Key Formula

$$x_t = c + \phi x_{t-1} + \epsilon_t$$

MA: Key Points

- Current value depends on past shocks

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- MA(1): $x_t = mu + e_t + theta\ e_{t-1}$

MA: Key Points

- Current value depends on past shocks
- MA(1): $x_t = mu + e_t + theta\ e_{t-1}$
- Captures short-term shock effects

MA: Key Formula

$$x_t = \mu + \epsilon_t + \theta\epsilon_{t-1}$$

Exercise 1: AR intuition

If phi=0.8 and last value is high (ignore noise), what happens next?

Solution 1

- Next value tends to be high too.

Exercise 2: MA intuition

In MA(1), what drives the series: past values or past shocks?

Solution 2

- Past shocks (errors).

Exercise 3: White noise

What is white noise?

Solution 3

- Uncorrelated errors with mean 0 and constant variance.

Mini Demo (Python)
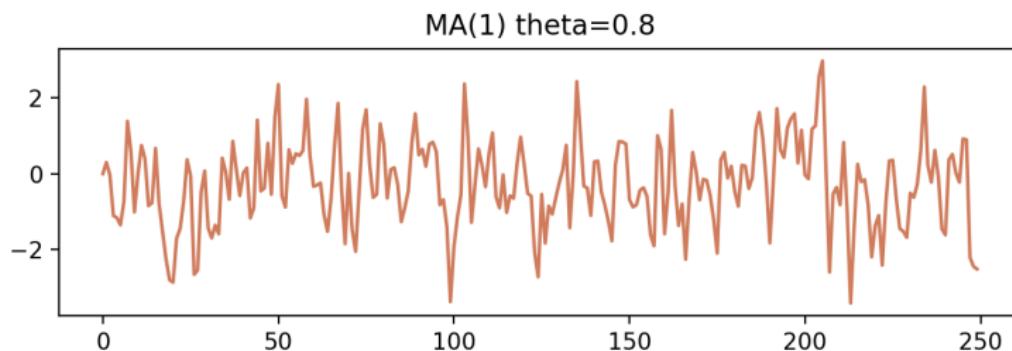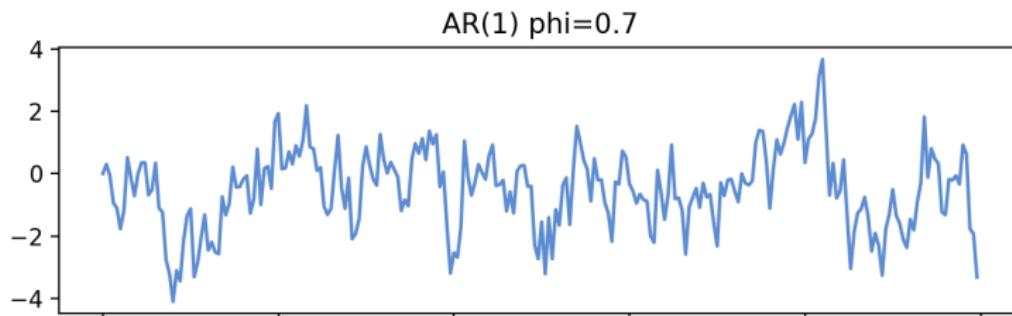
Run from the lecture folder:

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

Outputs:

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

Demo Output (Example)

AR(1) phi=0.7

MA(1) theta=0.8

Summary

- Key definitions and the main formula.

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- How to interpret results in context.

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- Key definitions and the main formula.
- How to interpret results in context.
- How the demo connects to the theory.

Exit Question

How are AR and MA models different in what they remember?