The N=1 autoregressive model

Modeling Intensive Longitudinal Data

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Autoregressive models: Simple models

Why autoregressive modeling?

- Simple model: Linear regression relationships, continuous variables
- Appealing interpretation
- Basis for or related to many other dynamic models
- Relatively common in the social science literature

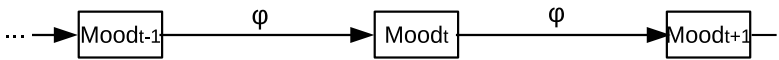
Autoregressive Modeling: The Basic Idea

> “The best predictor of future behavior is past behavior”

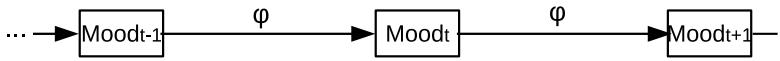
The N=1 Univariate Model (AR Model)

- Model for the time series of a specific person (N=1, T=many)
- Variable is regressed on itself at (a) previous occasion(s)

AR(1) model: Regressed on the nearest previous occasion



The N=1 AR(1) Model



Mood t	Mood t-1
5	.
3	5
3	3
4	3
2	4
3	2
1	3
1	1
2	1
.	2

Lags

Y
y_1
y_2
y_3
y_4
y_5
y_6
y_7
y_8
...
y_T

Lags

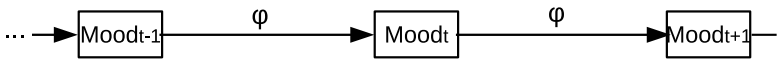
Y	Y at lag 1
y_1	
y_2	y_1
y_3	y_2
y_4	y_3
y_5	y_4
y_6	y_5
y_7	y_6
y_8	y_7
$\dots$	$\dots$
y_T	y_{T-1}
	y_T

Lags

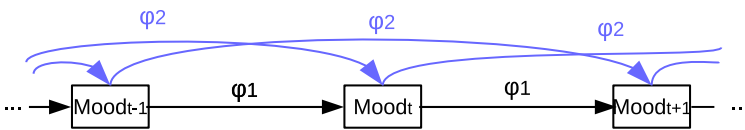
Y	Y at lag 1	Y at lag 2
y_1		
y_2	y_1	
y_3	y_2	y_1
y_4	y_3	y_2
y_5	y_4	y_3
y_6	y_5	y_4
y_7	y_6	y_5
y_8	y_7	y_6
$\dots$	$\dots$	$\dots$
y_T	y_{T-1}	y_{T-2}
	y_T	y_{T-1}
		y_T

The N=1 Univariate Model (AR Model)

- **AR(1) model:** on the nearest previous occasion

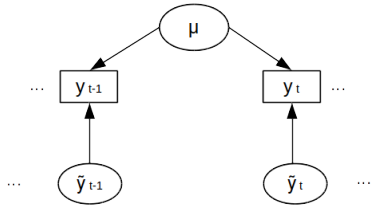


- **AR(2) model:** on the nearest previous occasion, and the occasion before that

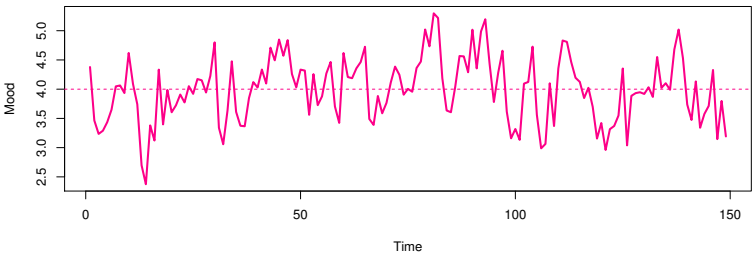


- **AR(3) model:** on the nearest previous occasion, and the occasion before that, and the one before that
- etc.

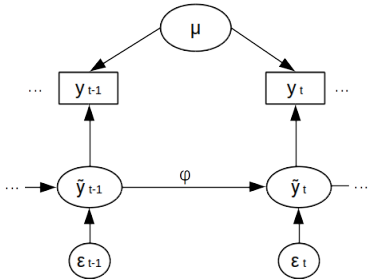
The N=1 AR(1) Model: Delving Deeper



$$y_t = \mu + \tilde{y}_t$$



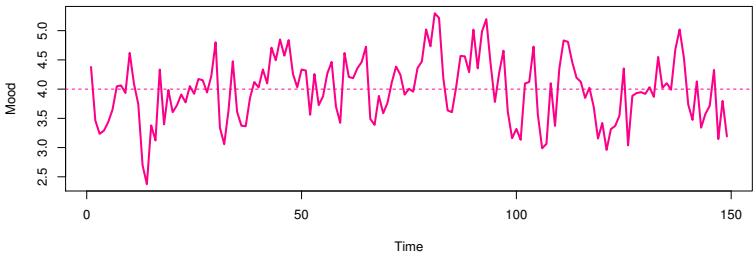
The N=1 AR(1) Model: Delving Deeper



$$y_t = \mu + \tilde{y}_t$$

$$\tilde{y}_t = \phi \tilde{y}_{t-1} + \epsilon_t$$

$$\epsilon_t \sim \mathit{Normal}\left(0, \sigma^2\right)$$



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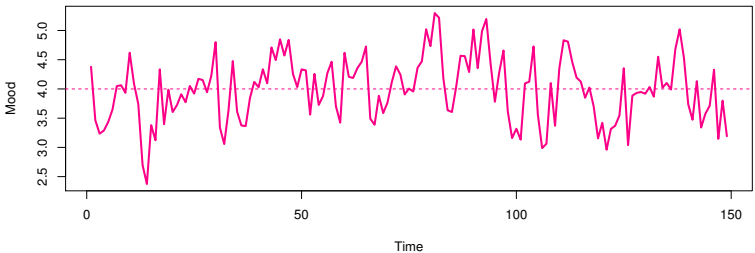
The N=1 AR(1) Model: Delving Deeper

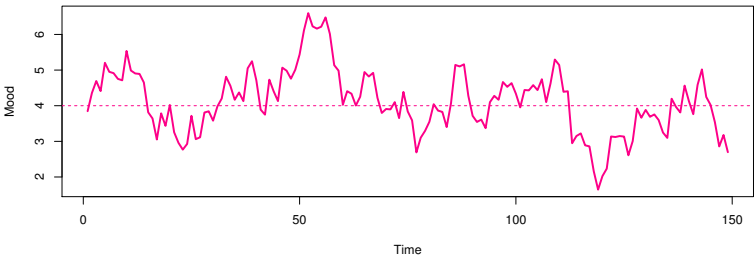
- In the AR(1) model ϕ lies between -1 and 1



AR(1) with $\phi = .5$

The N=1 AR(1) Model: Delving Deeper

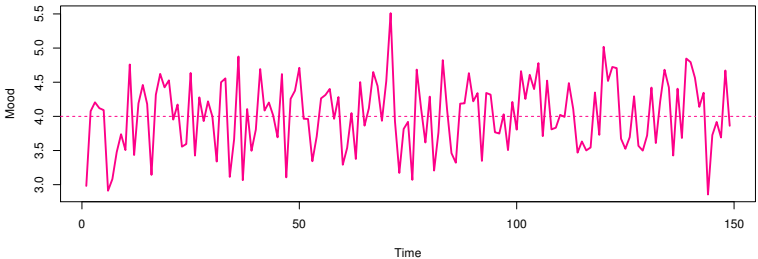
- In the AR(1) model ϕ lies between -1 and 1



AR(1) with $\phi = .8$

The N=1 AR(1) Model: Delving Deeper

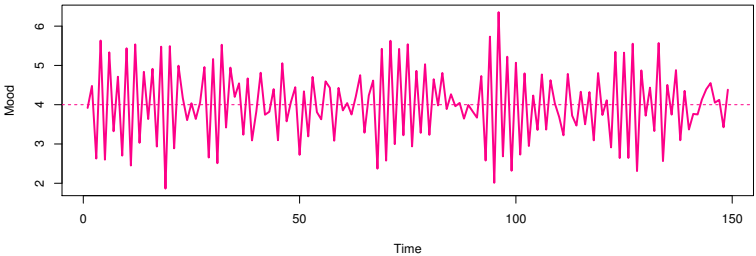
- In the AR(1) model ϕ lies between -1 and 1



AR(1) with $\phi = 0$

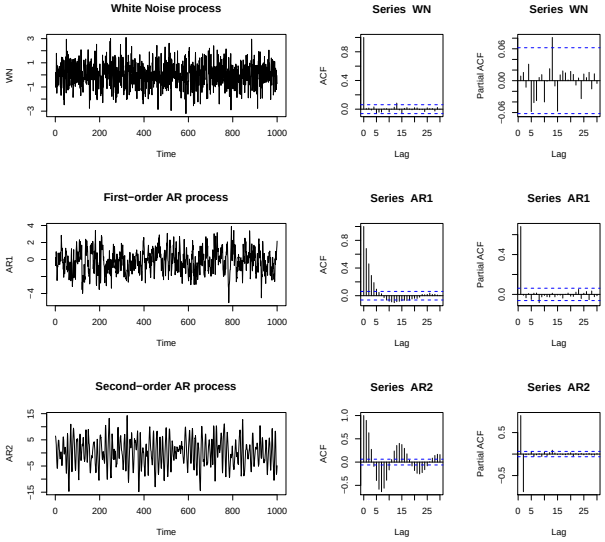
The N=1 AR(1) Model: Delving Deeper

- In the AR(1) model ϕ lies between -1 and 1



AR(1) with ϕ = -.8

Sequence, ACF and PACF



The N=1 AR(1) Model: Psychological Practice

The autoregressive effect as inertia and resilience

- Emotional inertia positively related with psychological maladjustment (Kuppens et al. 2011)
- Emotional inertia positively related with rumination and depression severity (Koval, 2012)
- Emotional inertia predicts the onset of depressive disorder in adolescence (Kuppens et al. 2015)

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