Subject: Re: pth order auto-regressive process with a specified mean and variance
Posted by Yngvar Larsen on Mon, 13 Feb 2012 15:04:05 GMT
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On Feb 13, 9:19 am, Tom Van Niel <mookiethe...@gmail.com> wrote:
> Hi Guys,
>
> Does anybody have IDL code that simulates a pth order auto-regressive
> process with a specified mean and variance? If so, please let me
> know.
>

Well. Assuming that the parameters of your AR(p) process is
chosen such that the process is wide-sense stationary, this should be
easy:

```
xmean = 0.9
xvariance = 1.2
;; This example vector of AR(4) coefficients
;; results in a WSS process.
;; Homework: make sure this is the case yourself.
;; (Hint: Roots of characteristic polynomial
;;        within unit circle)
;; My model:
;; X_t = \sum_{i=1}^p a_iX_{t-i} + n_t
;; with n_t iid normal.
;; Array A below contains (after reverse)
;; A = [a_{p-1}, ..., a_2, a_1]
A = reverse([2.7607, -3.8106, 2.6535, -0.9238])
p = n_elements(A)
transient = 1000 ; Transient throwaway points
npoints = 10000 + transient

drive_proc = sqrt(xvariance)*randomn(seed, npoints)
ar_proc = fltarr(npoints)
ar_proc[0] = drive_proc[0]
for ii=1, p-1 do $
  ar_proc[ii] = drive_proc[ii] + $
  total(A[p-ii:*]*ar_proc[0:ii-1])

for ii=p, npoints-1 do $
  ar_proc[ii] = drive_proc[ii] + $
  total(A*ar_proc[ii-p:ii-1])

;; Remove transient points, where
;; the process isn't WSS yet.
;; Add mean value.
ar_proc = ar_proc[transient:*] + xmean
```

--
Yngvar

Subject: Re: pth order auto-regressive process with a specified mean and variance
Posted by David Fanning on Mon, 13 Feb 2012 15:11:26 GMT

Yngvar Larsen writes:

> Well. Assuming that the parameters of your AR(p) process is
> chosen such that the process is wide-sense stationary, this should be
> easy

When did this newsgroup get taken over by people
seemingly speaking gibberish!? :-(

Cheers,

David

P.S. I'm looking for my long lost math books now...

--
David Fanning, Ph.D.
Fanning Software Consulting, Inc.
Coyote's Guide to IDL Programming: http://www.idlcoyote.com/
Sepore ma de ni thui. ("Perhaps thou speakest truth.")

Subject: Re: pth order auto-regressive process with a specified mean and variance
Posted by Yngvar Larsen on Mon, 13 Feb 2012 16:18:12 GMT

On Feb 13, 4:11 pm, David Fanning <n...@idlcoyote.com> wrote:
> Yngvar Larsen writes:
>> Well. Assuming that the parameters of your AR(p) process is
>> chosen such that the process is wide-sense stationary, this should be
>> easy
>
> When did this newsgroup get taken over by people
> seemingly speaking gibberish!? :-(
>
> Cheers,

>
> David
>
> P.S. I'm looking for my long lost math books now...

:)

That sentence was maybe a bit too much for this newsgroup, but on
purpose since OP asked for a simple answer to a complicated question.
(Hence, the "Homework" part of the answer.)

P.S. This is statistical signal processing, so your math books might
not be the proper place to look for gibberish-to-english
translation :)

--
Yngvar

Subject: Re: pth order auto-regressive process with a specified mean and variance
Posted by David Fanning on Mon, 13 Feb 2012 17:11:31 GMT

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Yngvar Larsen writes:

> P.S. This is statistical signal processing, so your math books might
> not be the proper place to look for gibberish-to-english
> translation :)

Ah, yeah, I was chasing one of those lithe modern dance
majors and skipped most of that class! ;-)

Cheers,

David

--
David Fanning, Ph.D.
Fanning Software Consulting, Inc.
Coyote's Guide to IDL Programming: http://www.idlcoyote.com/
Sepore ma de ni thui. ("Perhaps thou speakest truth.")

Subject: Re: pth order auto-regressive process with a specified mean and variance
Posted by Tom Van Niel on Tue, 14 Feb 2012 01:52:57 GMT

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Hi Yngvar,

That is just what I need. At the moment, I'm only using AR(1), so as
long as I keep the parameter < 1, it should remain WSS. If I use
AR(2) or greater, then I'll see if I can figure out the homework you
have assigned :)

David, no need to look up your textbooks when Wikipedia is around,
although it sounds like it brought back some good memories.

Thanks

Yngvar Larsen wrote:
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>>
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> p = n_elements(A)
> transient = 1000 ; Transient throwaway points
> npoints = 10000 + transient
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> drive_proc = sqrt(xvariance)*randomn(seed, npoints)
> ar_proc = fltarr(npoints)
> ar_proc[0] = drive_proc[0]
> for ii=1, p-1 do $
>   ar_proc[ii] = drive_proc[ii] + $
>   total(A[p-ii:*]*ar_proc[0:ii-1])

```
>
> for ii=p, npoints-1 do $
>    ar_proc[ii] = drive_proc[ii] + $
>    total(A*ar_proc[ii-p:ii-1])
>
> ;; Remove transient points, where
> ;; the process isn't WSS yet.
> ;; Add mean value.
> ar_proc = ar_proc[transient:*] + xmean
>
> --
> Yngvar
```