IDL
Interactive Data Language

A Program Language used for data analysis & imaging processing
(e.g., astronomy, atmospheric physics, medical imaging)

Fun facts:

1. David Stern (Univ. Colorado; Lab for Atmospheric & Space Physics)

   1970s, PDP-12 -> SOL; He then found a company **"research system Inc (RSI)"**

   -> Exelis Visual Information Solutions -> Harris Corporations (2015)

Fun facts:

1. David Stern (Univ. Colorado; Lab for Atmospheric & Space Physics)

   1970s, PDP-12 -> SOL; He then found a company **"research system Inc (RSI)"**

   -> Exelis Visual Information Solutions -> Harris Corporations (2015)

2. First customer ? NASA

   Halley's Comet imaging processing

   HST's repairing team used IDL to diagnose main mirror problem

Fun facts:

1. David Stern (Univ. Colorado; Lab for Atmospheric & Space Physics)

   1970s, PDP-12 -> SOL; He then found a company **"research system Inc (RSI)"**

   -> Exelis Visual Information Solutions -> Harris Corporations (2015)

2. First customer ? NASA

   Halley's Comet imaging processing

   HST's repairing team used IDL to diagnose main mirror problem

Not-So-Fun Facts:

License not free & expensive : (

Fun facts:

1. David Stern (Univ. Colorado; Lab for Atmospheric & Space Physics)
   1970s, PDP-12 -> SOL; He then found a company **"research system Inc (RSI)"**
   -> Exelis Visual Information Solutions -> Harris Corporations (2015)

2. First customer ? NASA

   Halley's Comet imaging processing

   HST's repairing team used IDL to diagnose main mirror problem

Not-So-Fun Facts:

License not free & expensive : (

Is it necessary to learn IDL ?

IDL vs. IRAF, FORTRAN/C/C++, Python, Matlab
other special packages (CIAO, STSDAS, AIPS)

Lots of Online Resources

Get Started

IDL Commands and Syntax (colorado.edu)
A Slug's Guide to IDL (google pls)
A GUIDE TO IDL FOR ASTRONOMERS (virginia.edu)
Carl Heiles's Quick IDL Tutorial

More advanced

Coyotes' Guide to IDL
David Fanning IDL programming Techniques

Libraries

Astrolib (NASA)
JHU IDL Library
TeXtoIDL

Many online personal collections:

Rob Dimeo's IDL programs
Robbie's IDL Programming
:
&
many many others

IDL
Interactive Data Language

A Program Language used for data analysis & imaging processing
(e.g., astronomy, atmospheric physics, medical imaging)

Have a clear logic

Have a good coding habit (always write instructions !)

From astrolib:

GOOD

```
pro kstwo, data1, data2, D, prob
;+
; NAME:
;       KSTWO
; PURPOSE:
;       Return the two-sided Kolmogorov-Smirnov statistic
; EXPLANATION:
;       Returns the Kolmogorov-Smirnov statistic and associated probability
;       that two arrays of data values are drawn from the same distribution
;       Algorithm taken from procedure of the same name in "Numerical
;       Recipes" by Press et al., 2nd edition (1992), Chapter 14
;
; CALLING SEQUENCE:
;       kstwo, data1, data2, D, prob
;
; INPUT PARAMATERS:
;       data1 -  vector of data values, at least 4 data values must be include
;               for the K-S statistic to be meaningful
;       data2 -  second set of data values, does not need to have the same
;               number of elements as data1
;
; OUTPUT PARAMETERS:
;       D - floating scalar giving the Kolmogorov-Smirnov statistic.   It
;               specifies the maximum deviation between the cumulative
;               distribution of the data and the supplied function
;       prob - floating scalar between 0 and 1 giving the significance level of
;               the K-S statistic.   Small values of PROB show that the
;               cumulative distribution function of DATA1 is significantly
;               different from DATA2
;
; EXAMPLE:
;       Test whether two vectors created by the RANDOMN function likely came
;       from the same distribution
;
;       IDL> data1 = randomn(seed,40)        ;Create data vectors to be
;       IDL> data2 = randomn(seed,70)        ;compared
;       IDL> kstwo, data1, data2, D, prob   & print,D,prob
;
; PROCEDURE CALLS
;       procedure PROB_KS - computes significance of K-S distribution
;
; REVISION HISTORY:
;       Written     W. Landsman                 August, 1992
;       FP computation of N_eff      H. Ebeling/W. Landsman  March 1996
;       Converted to IDL V5.0   W. Landsman   September 1997
;       Fix for arrays containing equal values J. Ballet/W. Landsman Oct. 2001
;-
  On_error, 2

 if ( N_params() LT 4 ) then begin
    print,'Syntax - KSTWO, data1, data2, d, prob'
    return
```

From myself:

BAD

```
pro mapcube,ps=ps
device, decomposed=0
loadcolors
if keyword_set(ps) then setps_a4
if keyword_set(ps) then device,file='ha_on_hstv5.eps',/land,/col

;fits_read,'finalcubev5.fits',cube,hdrf
fits_read,'finalcube_fcupdateflux.fits',cube,hdrf ;;; update flux, 10^-16 unit
sz = size(cube)
halpha = fltarr(sz[1],sz[2])
nii0=halpha
for i=0,sz[1]-1 do for j=0,sz[2]-1 do halpha[i,j] = total(cube[i,j,197:207])  ;;1
for i=0,sz[1]-1 do for j=0,sz[2]-1 do nii0[i,j] = total(cube[i,j,223:232])  ;;1.6

halpha = filter_image(halpha,fwhm=2.5,/all)
nii0 = filter_image(nii0,fwhm=2.5,/all)

;;;; Make new header for the Halpha image
fits_read,'s100303_a023001_Hn3_100.fits',junk,asthdr
ctype1 = sxpar(asthdr,"CTYPE2")     ;; RA  tan yori note, ctype1 of HST image is
ctype2 = sxpar(asthdr,"CTYPE3")     ;; DEC tan xori
mkhdr,newhdr,halpha,/im
sxaddpar,newhdr,"crval1",177.39710
sxaddpar,newhdr,"crval2",22.39601
sxaddpar,newhdr,"cdelt1",-2.7777778e-05    ;;;0.1"/pixel=> 0.1"/3600 = 2.77778e-5
sxaddpar,newhdr,"cdelt2",2.7777778e-05
sxaddpar,newhdr,"crpix1",29
sxaddpar,newhdr,"crpix2",39.5
sxaddpar,newhdr,"ctype1",CTYPE1
sxaddpar,newhdr,"ctype2",CTYPE2
sxaddpar,newhdr,"equinox",2000.0

writefits,'halpha_updateflux.fits',halpha,newhdr
hast0=halpha*100.
writefits,'halpha_updateflux_unit16std.fits',halpha*100.,newhdr
ok1=where(hast0 gt 1.)
hast=hast0-hast0 & hast[ok1]=hast0[ok1]
writefits,'halpha_updateflux_unit16std_gt1.fits',hast,newhdr

ok1=where(hast0 gt 0.8)
hast=hast0-hast0 & hast[ok1]=hast0[ok1]
writefits,'halpha_updateflux_unit16std_gt0.5.fits',hast,newhdr
halphatmp=hast/100.
```

Commands (Procedures)

"IDL> procedure_name, arg1, arg2, ..."
where arg1, arg2 can be either input or output.

Function

"IDL> returnvalue = function_name(arg1, arg2, ...)"

Keywords

"IDL> procedure_name, arg1, keyword=3"

/keyword is the same as keyword=1.

Little things I wish someone told me before:

1. File name Case SensitiVE (no capital letters!)
   e.g., case.pro, but not CASE.pro

> What this suggests to me
> is that you cannot have a file that stores a routine and name it with
> capital letters. That is

> dumb. Someone please tell me that I'm right???

Uh, well, I think this has been well known since
about 1956. :-)

Cheers,

David
--
David W. Fanning, Ph.D.
Fanning Software Consulting, Inc.
Phone: 970-221-0438, E-mail: da...@dfanning.com
Coyote's Guide to IDL Programming: http://www.dfanning.com/
Toll-Free IDL Book Orders: 1-888-461-0155

plotting examples: see demo

- **see also Online Resources for fancier things you can to make prettier plots**

- **IDL can handle 3D plots and animations quite well**

- **Please read this to understand IDL color models, http://www.geo.mtu.edu/geoschem/docs/IDL_Manuals/working_with_color.pdf**

device, decomposed=0 vs.
device, decomposed=1

Read and write ASCII files: see demo

Little things I wish someone told me before:

2.
> When you open a file for writing, 80 columns is the default maximum
> for historical reasons. (Are you old enough to remember
> punch cards?)

e.g., in textopen.pro
openw, !TEXTUNIT, ‘laser.tmp'
add
openw, !TEXTUNIT, ‘laser.tmp',WIDTH=1200

Manipulating FITS files: see assignments

Read FITS file:

"IDL> image = **mrdfits**('filename', 0, header, /fscale, /silent)"

(alternative: fits_read,'filename',image,header,exten_no=0)

idl will read the fits file into this idl name "image", can be any name.

" 'filename' " is the name of the fits file.

"0" means fits extension number. It's usually 0.

"header" will return FITS header info in idl

"/fscale" rescale to original data

"/silent" suppress info messages.

Write FITS file:

"IDL> **mwrfits**, image, 'filename', header, /create"

"/create" overwrite existing file.

(alternative: writefits)

Get FITS file information

"IDL> fits_info,'s100303_a023001_Hn3_100.fits'


Start Demo