Just tired of endless loops!
or `parallel`: Stata module for parallel computing

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Agenda

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- `parallel` aims to make a contribution to these issues.

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- It implements parallel computing methods through an OS's shell scripting (using Stata in batch mode) to accelerate computations.
- Depending on the task, can reach near to (or over) linear speedups proportional to the number of physical cores of the computer.
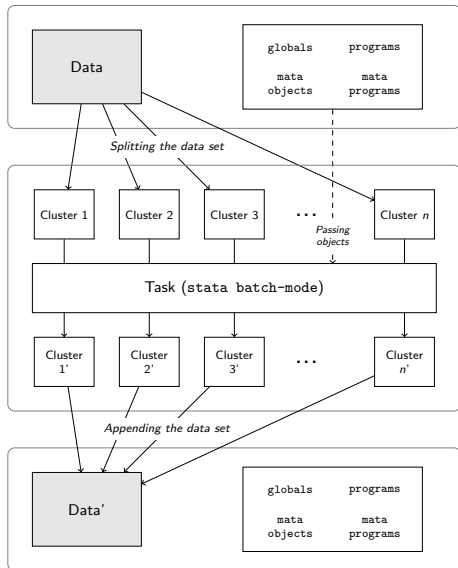- Thus having a quad-core computer can lead to a 400% speedup.

What is and how does it work

How does it work?

Sounds "pretty" but...

Sounds "pretty" but…is this for real!?

When the user enters

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  cap clear all
  cd ~
1 set seed 34815
  set memory 16777216b
  cap set maxvar 5000
  cap set matsize 400
2 local pll_instance 1
  local pll_id efcql2tspr
  capture {
  noisily {
3 use __pllefcql2tsprdataset if _efcql2tsprcut == 1
  gen n = _N
  }
  }
4 save __pllefcql2tsprdta1, replace
  local result = _rc
  cd ~
5 mata: write_diagnosis(st_local("result"),
  >" __pllefcql2tsprfinito1")
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```
  cap clear all
  cd ~
1 set seed 98327
  set memory 16777216b
  cap set maxvar 5000
  cap set matsize 400
2 local pll_instance 2
  local pll_id efcql2tspr
  capture {
  noisily {
3 use __pllefcql2tsprdataset if _efcql2tsprcut == 2
  gen n = _N
  }
  }
4 save __pllefcql2tsprdta2, replace
  local result = _rc
  cd ~
5 mata: write_diagnosis(st_local("result"),
  >"__pllefcql2tsprfinito2")
```

Ok, it works but...

Ok, it works but...
it must be really hard to use!

Benchmarks
Simple example: Serial replace

Serial fashion

`do mydofile.do`

Parallel fashion

`parallel do mydofile.do`

Figure: mydofile.do

```
local size = _N
forval i=1/'size' {
        qui replace x = ///
            1/sqrt(2*'c(pi)')*exp(-(x^2/2)) in 'i'
}
```

Table: Serial replacing using a loop on a Linux Server (16 clusters)

	100.000	1.000.000	10.000.000
CPU	1.43	16.94	144.68
Total	0.34	3.20	12.49
Setup	0.00	0.00	0.00
Compute	0.32	3.07	11.54
Finish	0.02	0.12	0.95
Ratio (compute)	4.50	5.51	12.53
Ratio (total)	4.22 (26%)	5.30 (30%)	11.58 (72%)

Tested on a Intel Xeon X470 (hexadeca-core) machine

Figure: myexperiment.do

```
local num_of_intervals = 50
if length("`pll_id'") == 0 {
    local start = 1
    local end = `num_of_intervals'
}
else {
    local ntot = floor(`num_of_intervals'/$PLL_CLUSTERS)
    local start = (`pll_instance' - 1)*`ntot' + 1
    local end = (`pll_instance')*`ntot'
    if `pll_instance' == $PLL_CLUSTERS local end = 10
}
local reps 10000
forval i=`start'/`end' {
    qui use census2, clear
    gen true_y = age
    gen x_factor = region
    sum x_factor, meanonly
    scalar xmu = r(mean)
    qui {
        gen y1 = .
        gen y2 = .
        local c = `i'
        set seed `c'
        simulate c=r(c) mu1=r(mu1) se_mu1 = r(se_mu1) ///
                 mu2=r(mu2) se_mu2 = r(se_mu2), ///
                 saving(c`i', replace) nodata reps(`reps'): ///
                 mcsim11, c(`c')
    }
}
```

Serial fashion

do myexperiment.do

Parallel fashion

parallel do myexperiment.do, nodata

Table: Monte Carlo Experiment on a Windows Machine (4 clusters)

	2	4
CPU	111.49	114.13
Total	58.02	37.48
Setup	0.00	0.00
Compute	58.02	37.48
Finish	0.00	0.00
Ratio (compute)	1.92	3.04
Ratio (total)	1.92 (96%)	3.04 (76%)

Tested on a Intel i3 2120 (dual-core) machine

Serial fashion

```
do myexperiment.do
```

Parallel fashion

```
parallel do myexperiment.do, nodata
```

Table: Monte Carlo Experiment on a Linux Server (16 clusters)

	2	4	8	16
CPU	164.79	164.04	162.84	163.89
Total	69.85	34.28	19.00	10.78
Setup	0.00	0.00	0.00	0.00
Compute	69.85	34.28	19.00	10.78
Finish	0.00	0.00	0.00	0.00
Ratio (compute)	2.36	4.78	8.57	15.21
Ratio (total)	2.36 (118%)	4.78 (120%)	8.57 (107%)	15.21 (95%)

Tested on a Intel Xeon X470 (hexadeca-core) machine

Serial fashion

```
reshape wide tipsolic rutemp opta derecho ngiros, ///
        i(id) j(time)
```

Parallel fashion

```
parallel, by(id) :reshape wide tipsolic rutemp opta derecho ngiros, ///
        i(id) j(time)
```

Table: Reshaping wide a large database on a Linux Server (8 clusters)

	100.000	1.000.000	5.000.000
CPU	5.51	72.70	392.97
Total	2.33	17.46	86.44
Setup	0.00	0.00	0.00
Compute	1.83	12.42	57.93
Finish	0.50	5.04	28.51
Ratio (compute)	3.01	5.85	6.78
Ratio (total)	2.37 (29%)	4.16 (52%)	4.55 (57%)

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Setup

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By syntax

parallel [, by(*varlist*) programs <u>m</u>ata <u>s</u>eeds(*string*) <u>r</u>andtype(*random.org|datetime*)
<u>p</u>rocessors(*integer*) <u>no</u>data]: *stata_cmd*

Syntax and Usage

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By syntax

parallel [, by(*varlist*) p̲rograms m̲ata s̲eeds(*string*) r̲andtype(*random.org|datetime*)
p̲rocessors(*integer*) n̲odata]: *stata_cmd*

Do syntax

parallel do *filename*
[, by(*varlist*) p̲rograms m̲ata s̲eeds(*string*) r̲andtype(*random.org|datetime*)
p̲rocessors(*integer*) n̲odata]

Syntax and Usage
Recomendations on its usage

```
parallel suit ...
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- ▶ (already) fast commands.
- ▶ Regressions, ARIMA, etc.
- ▶ Linear Algebra.
- ▶ Whatever StataMP does better.

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  - `parnnmatch`
  - ... You name it!

Thank you very much!

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