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☞ MICROTALK — PDFSPLIT
☞ Luigi SCARSO

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MicroTalk – pdfsplit

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LUIGI SCARSO

Abstract: MicroTalk is a short and technical paper that shows some unusual, hopefully useful, ideas following the schema “figure to code”. The main topic is always typographic programming in ConTEXt & Lua. A bit of Lua code, the `\clip` macro and Leptonica extensions are the ingredients for this recipe to cook a pdfsplit macro that take a pdf and try to split into parts as the `\vsplit` does with `\vboxes`.

Key words: Lua, Leptonica, PDF slicing, SWIG, MuPDF, Sumatra.

Abstrakt: Článek poukazuje na způsob nařezání PDF na proužky tak, jak je to známé pomocí příkazu `\vsplit` s `\vboxy`.

Klíčová slova: Lua, Leptonica, vysekávání z PDF, SWIG, MuPDF, Sumatra.

References

- [1] Leptonica. Available at URL: <http://www.leptonica.com/>
- [2] MuPDF – a lightweight PDF viewer and toolkit written in portable C. Available at URL: <http://www.mupdf.com/>
- [3] Sumatra PDF. Available at URL: http://en.wikipedia.org/wiki/Sumatra_PDF

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1 Slice a pdf

Let's start with a bit of Lua code:

```
\startluacode
document.lscarsos = document.lscarsos or {}
function document.lscarsos.LuaSliceIt(Fig,H,W,L,FigOpt)
  local H = math.floor(string.gsub(H,"pt","")*2^16)
  local W = math.floor(string.gsub(W,"pt","")*2^16)
  local L = math.floor(string.gsub(L,"pt","")*2^16)
  local vh = 0
  local step = L
  local h = step
  local S = ""
  local FigOpt = FigOpt or ""
  while vh <= H do
    S =string.format("{\\clip[voffset=%dsp,
                    width=%dsp,
                    height=%dsp]
                    {\\externalfigure[%s] [%s]}}
                    \\par\\nointerlineskip\\blank[1sp]",
                    vh,W,h,Fig,FigOpt)
    tex.sprint(tex.ctxcatcodes,S)
    vh = vh + step
  end
  if math.mod(H,step) > 0 then
    vh = vh - step + math.mod(H,step)
    S =string.format("{\\clip[voffset=%dsp,
                    width=%dsp,
                    height=%dsp]
                    {\\externalfigure[%s] [%s]}}
                    \\par\\nointerlineskip\\blank[1sp]",
                    vh,W,math.mod(H,step),Fig,FigOpt)
    tex.sprint(tex.ctxcatcodes,S)
  end
end
\stoptluacode
```

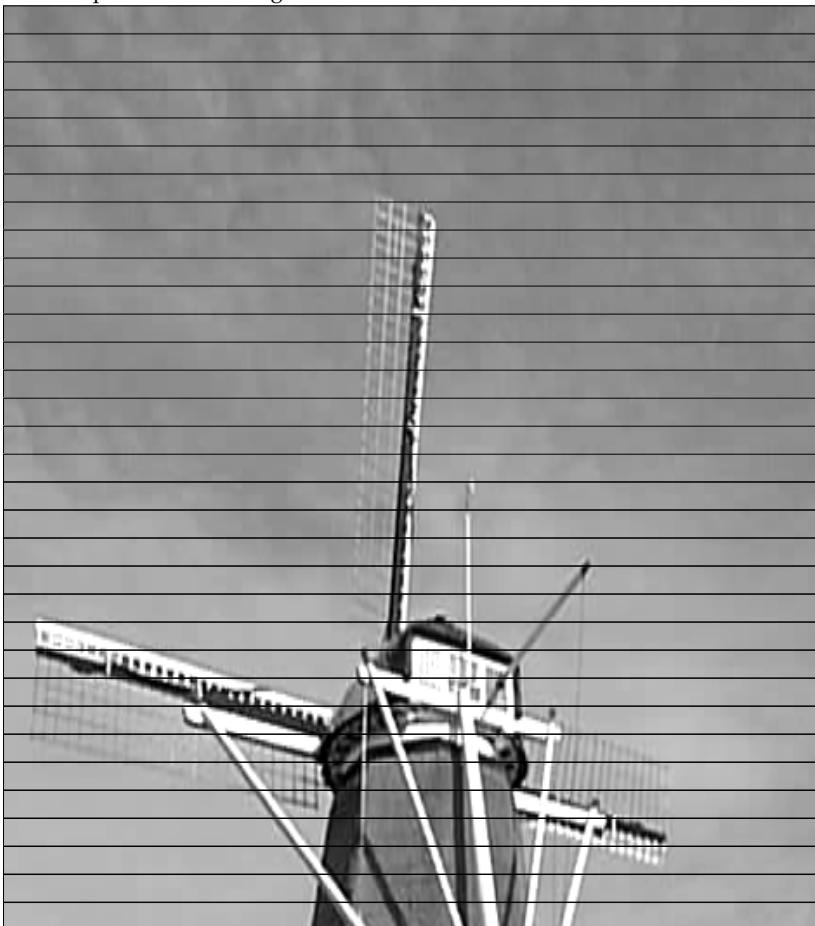
`document.lscarsos.LuaSliceIt` takes a pdf and “slices it” with slices of height `L`.

```

\bgroup
\newdimen\Hfig \newdimen\Wfig
\setbox1000=\hbox{\externalfigure[mill.png] [width=\textwidth,
height=1.3\textheight]}
\Wfig=\wd1000 \Hfig=\dimexpr\ht1000+\dp1000\relax%
\ctxlua{document.lscarso.LuaSliceIt("mill.png", "\the\Hfig",
"\the\Wfig", "\the\dimexpr 1.0\lineheight\relax",
"width=\textwidth,height=1.3\textheight")}
\egroup

```

It's not a problem with images:





But uniform slicing is wrong with text:

$\sum_{x=0}^{10} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877345$
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{1463919079240743966268954674710929768361083}{281670315928038407744716588098661706369472} = 5.197278507738630161795216686$
$\sum_{x=0}^{150} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$
$\sum_{x=0}^{100} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$
$\sum_{x=0}^{300} \frac{-1^x}{2x+1} = 3.1441914903558851799204586212$
$\sum_{x=0}^{3000} \frac{-1^x}{2x+1} = 3.1411925075039790151271200075$
$\sum_{x=0}^{30000} \frac{-1^x}{2x+1} = 3.141625985812043238153993692$
$\sum_{x=0}^{300000} \frac{-1^x}{2x+1} = 3.141595986912015488462612519$

$\sum_{x=0}^{\infty} 2x + 1$	
$4 \sum_{x=0}^{300000} \frac{-1^x}{2x+1} = 3.141592986923015460712643380$	

We can enumerate each slice, and observe that it depends only on the given step:
with `step = 1.0\lineheight` we have

$\sum_{x=0}^{10} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877345$	001
	002
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{1463919079240743966268954674710929768361083}{281670315928038407744716588098661706369472} = 5.197278507738630161795216686$	003
	004
$\sum_{x=0}^{150} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	005
	006
$\sum_{x=0}^{20} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	007
	008
$4 \sum_{x=0}^{300} \frac{-1^x}{2x+1} = 3.144914903558851799204586212$	009
	010
$\sum_{x=0}^{3000} \frac{-1^x}{2x+1} = 3.1414925875039798151271208075$	011
	012
$4 \sum_{x=0}^{30000} \frac{-1^x}{2x+1} = 3.141625985812043238153993692$	013
	014
$4 \sum_{x=0}^{300000} \frac{-1^x}{2x+1} = 3.141595986912015488462612519$	015
	016
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = 3.141592986923015460712643380$	017
	018
	019
	020

It's now clear that 002, 004, 006... are good break points while 001, 003, 005... must be avoided: if we collect all good break points we can then subdivide the pdf into the right `\vboxes`. These break points depend on `lineheight`, but we can choose another step, let's say `2mm`, so that slices are independent from the body font:

```
\bgroup
\newdimen\Hfig \newdimen\Wfig
\setbox1000=\hbox{\externalfigure[pari_example.pdf] [width=\textwidth]}
\Wfig=\wd1000 \Hfig=\dimexpr\ht1000+\dp1000\relax%
\ctxlua{document.lscarso.LuaSliceItNR("pari_example.pdf", "\the\Hfig",
" \the\Wfig", "\the\dimexpr 2mm\relax",
"width=\textwidth") }
\egroup
```

$\sum_{x=0}^{10} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877345$	001
	002
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{1463919079240743966268954674710929768361083}{281670315928038407744716588098661706369472} = 5.197278507738630161795216686$	003
	004
$\sum_{x=0}^{150} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	005
	006
$\sum_{x=0}^{20} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	007
	008
$4 \sum_{x=0}^{300} \frac{-1^x}{2x+1} = 3.144914903558851799204586212$	009
	010

$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	011
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	012
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	013
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	014
$4 \sum_{x=0}^{30} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	016
$4 \sum_{x=0}^{30} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	017
$4 \sum_{x=0}^{30} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	018
$4 \sum_{x=0}^{300} \frac{-1^x}{2x+1} = \frac{3.144914903558851799204586212}{3.144914903558851799204586212}$	019
$4 \sum_{x=0}^{300} \frac{-1^x}{2x+1} = \frac{3.144914903558851799204586212}{3.144914903558851799204586212}$	020
$4 \sum_{x=0}^{300} \frac{-1^x}{2x+1} = \frac{3.144914903558851799204586212}{3.144914903558851799204586212}$	022
$4 \sum_{x=0}^{3000} \frac{-1^x}{2x+1} = \frac{3.141925875839790151271200075}{3.141925875839790151271200075}$	023
$4 \sum_{x=0}^{3000} \frac{-1^x}{2x+1} = \frac{3.141925875839790151271200075}{3.141925875839790151271200075}$	024
$4 \sum_{x=0}^{3000} \frac{-1^x}{2x+1} = \frac{3.141925875839790151271200075}{3.141925875839790151271200075}$	025
$4 \sum_{x=0}^{3000} \frac{-1^x}{2x+1} = \frac{3.141925875839790151271200075}{3.141925875839790151271200075}$	026
$4 \sum_{x=0}^{30000} \frac{-1^x}{2x+1} = \frac{3.141625985812043238153993692}{3.141625985812043238153993692}$	028
$4 \sum_{x=0}^{30000} \frac{-1^x}{2x+1} = \frac{3.141625985812043238153993692}{3.141625985812043238153993692}$	029
$4 \sum_{x=0}^{30000} \frac{-1^x}{2x+1} = \frac{3.141625985812043238153993692}{3.141625985812043238153993692}$	030
$4 \sum_{x=0}^{300000} \frac{-1^x}{2x+1} = \frac{3.141595986912015488462612519}{3.141595986912015488462612519}$	031
$4 \sum_{x=0}^{300000} \frac{-1^x}{2x+1} = \frac{3.141595986912015488462612519}{3.141595986912015488462612519}$	032
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	033
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	034
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	035
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	036
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	038
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	039
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	040
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	041
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	042

We group together slices 1, 5, 9, 13, 14, 18, 22, 26, 31, 35, 39:

$\sum_{x=0}^{10} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877345$	001
$\sum_{x=0}^{10} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877345$	005
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{1463919079240743966268954674710929768361083}{281670315928038407744716588098661706369472} = 5.197278507738630161795216686$	009
$\sum_{x=0}^{150} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	013
$\sum_{x=0}^{150} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	014
$4 \sum_{x=0}^{30} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	018
$4 \sum_{x=0}^{30} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	022
$4 \sum_{x=0}^{3000} \frac{-1^x}{2x+1} = \frac{3.144914903558851799204586212}{3.144914903558851799204586212}$	026
$4 \sum_{x=0}^{3000} \frac{-1^x}{2x+1} = \frac{3.144914903558851799204586212}{3.144914903558851799204586212}$	031
$4 \sum_{x=0}^{30000} \frac{-1^x}{2x+1} = \frac{3.141625985812043238153993692}{3.141625985812043238153993692}$	035
$4 \sum_{x=0}^{300000} \frac{-1^x}{2x+1} = \frac{3.141595986912015488462612519}{3.141595986912015488462612519}$	039
$4 \sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = \frac{3.141592986923015460712643380}{3.141592986923015460712643380}$	042

Now slicing works well:

$\sum_{x=0}^{10} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877345$	001
$\sum_{x=0}^{10} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877345$	005
$\sum_{x=0}^{100} \frac{1}{x+1} = \frac{1463919079240743966268954674710929768361083}{281670315928038407744716588098661706369472} = 5.197278507738630161795216686$	009
$\sum_{x=0}^{150} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	013
$\sum_{x=0}^{150} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$	014
$4 \sum_{x=0}^{30} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$	018

$\sum_{x=0}^{300} \frac{-1^x}{2x+1} = 3.144914903558851799204586212$	022
$\sum_{x=0}^{3000} \frac{-1^x}{2x+1} = 3.141925875839790151271200075$	026
$\sum_{x=0}^{30000} \frac{-1^x}{2x+1} = 3.141625985812043238153993692$	031
$\sum_{x=0}^{300000} \frac{-1^x}{2x+1} = 3.141595986912015488462612519$	035
$\sum_{x=0}^{3000000} \frac{-1^x}{2x+1} = 3.141592986923015460712643380$	039
	042

```

\bggroup
\newdimen\Hfig \newdimen\Wfig
\setbox1000=\hbox{\externalfigure[pari_example.pdf][width=\textwidth]}
\Wfig=\wd1000 \Hfig=\dimexpr\ht1000+\dp1000\relax%
\startluacode
document.lscarlo.GoodPoints = {1,5,9,13,14,18,22,26,31,35,39}
\stopluacode
\ctxlua{document.lscarlo.LuaSliceItAndCollect("pari_example.pdf",
      "\the\Hfig","\the\Wfig","\the\dimexpr 2mm\relax",
      "width=\textwidth","")}
\egroup

function document.lscarlo.LuaSliceItAndCollect(Fig,H,W,L,FigOpt)
  local H = math.floor(string.gsub(H,"pt","")*2^16)
  local W = math.floor(string.gsub(W,"pt","")*2^16)
  local L = math.floor(string.gsub(L,"pt","")*2^16)
  local vh = 0
  local step = L
  local h = step
  local S = ""
  local FigOpt = FigOpt or ""
  local NR = 0
  local Payload = "{\ruledhbox{\clip[voffset=\%dsp,width=\%dsp,height=\%dsp]
{\externalfigure[\%s][\%s]}\llap{\tfx\%03d}}
\par\nointerlineskip\blank[1sp]"
  local GoodPoint = document.lscarlo.GoodPoints or {}
  local j = 1
  local Vboxes = {}
  local prevvh = 0
  while vh < H do
    NR =NR +1
    vh = vh + step
    if GoodPoint[j] == NR then
      Vboxes[#Vboxes+1] = {from=prevvh,to=vh,mark=NR}
      --tex.sprint(tex.ctxcatcodes,(" ,prevvh, ", ,vh, " )

```



```

    prevvh = vh
    j = j + 1
end
end
if math.mod(H,step) == 0 then H = H + 1 end
if math.mod(H,step) > 0 then
  NR = NR + 1
  vh = vh - step + math.mod(H,step)
  Vboxes[#Vboxes+1] = {from=prevvh,to=vh,mark=NR}
end
Payload = "\\ruledvbox{\\hbox{\\clip[voffset=\\%dsp,width=\\%dsp,height=\\%dsp]
{\\externalfigure[\\%s][\\%s]}\\llap{\\tfx\\%03d}}}}
\\par\\nointerlineskip\\blank[1sp]"
for i,v in ipairs(Vboxes) do
  S =string.format(Payload,v.from,W,v.to-v.from,Fig,FigOpt,v.mark)
  tex.sprint(tex.ctxcatcodes,S)
end
end

```

It's now rather trivial to modify this macro to build a `\vbox` to be used with `\vsplit`.

2 Leptonica

Leptonica (<http://www.leptonica.com>) is a pedagogically-oriented open source site containing software that is useful for image processing and image analysis applications. It's not difficult to build a binding for Lua with SWIG. To use Leptonica we must first convert the pdf in a black and white bitmap with

```
pdftoppm -mono -r 72 -f 1 -l 1 pari_example.pdf pari_example
```

(this saves page 1 in `pari_example-000001.pbm` with a resolution of 72dpi). Then we scan the bitmap with `lept_get_breaks` searching for a white row and we store the y coordinates in `GoodPoints`. In the end `LuaCollect` builds the appropriate `vboxes`.

```
\bgroup
\newdimen\Hfig \newdimen\Wfig
\setbox1000=\hbox{\externalfigure[pari_example.pdf][width=\textwidth]}
\Wfig=\wd1000\relax\Hfig=\dimexpr\ht1000+\dp1000\relax%
\executesystemcommand{pdftoppm -mono -r 72 -f 1 -l 1 pari_example.pdf
pari_example}
\ctxlua{document.lscarsio.GoodPoints =
    document.lscarsio.lept_get_breaks("pari_example-000001.pbm",72)}
\ctxlua{document.lscarsio.LuaCollect("pari_example.pdf",
    "\the\Hfig","\the\Wfig",[width=\textwidth])}
\egroup
```

Let's see what happens:

$\sum_{x=1}^{83711} \frac{1}{x+1} = \frac{83711}{27720} = 3.019877344877344877344877344877345$
$\sum_{x=1}^{1463919079240743966268954674710929768361083} \frac{1}{x+1} = \frac{1463919079240743966268954674710929768361083}{281670315928038407744716588098661706369472} = 5.197278507738630161795216686$
$\sum_{x=1}^{4195569667676135811153969815137073234944561746732919339914337201927} \frac{1}{x+1} = \frac{4195569667676135811153969815137073234944561746732919339914337201927}{749502901196827228266820481792118993292919127408542808267329424000} = 5.597803105200170187965715973$
$\sum_{x=1}^{58630135791001973169852284} \frac{-1^x}{2x+1} = \frac{58630135791001973169852284}{18472920064106597929865025} = 3.173842337190749408690224140$
$\sum_{x=1}^{3144914903558851799204586212} \frac{-1^x}{2x+1} = 3.144914903558851799204586212$
$\sum_{x=1}^{3141925875839790151271200075} \frac{-1^x}{2x+1} = 3.141925875839790151271200075$
$\sum_{x=1}^{3141625985812043238153993692} \frac{-1^x}{2x+1} = 3.141625985812043238153993692$
$\sum_{x=1}^{3141595986912015488462612519} \frac{-1^x}{2x+1} = 3.141595986912015488462612519$
$\sum_{x=1}^{3141592986923015460712643380} \frac{-1^x}{2x+1} = 3.141592986923015460712643380$

A good breakpoint is marked with an horizontal rule: a black stripe means that good points are very tight there.

```
require("leptonica")
function document.lscarso.lua_pixGetPixel(pixs,x,y)
    local scratch = 0
    local res = ''
    scratch = leptonica.uti_getref_l_uint32()
    if (leptonica.pixGetPixel(pixs,x,y,scratch) == 0) then
        res = leptonica.uti_valref_l_uint32(scratch)
    else
        print("! Error on ",x,y)
        res = ''
    end
    return res
end

function document.lscarso.lept_get_breaks(filename,res)
    -- os.execute([[pdftoppm -mono filename]])
    local mainName = filename
    local pixs = leptonica.pixRead(mainName)
    local lua_pixGetPixel = document.lscarso.lua_pixGetPixel
    local GoodPoint = {} -- document.lscarso.GoodPoints or {}
    if pixs then
        local w = leptonica.pixGetWidth(pixs)
        local h = leptonica.pixGetHeight(pixs)
        local d = leptonica.pixGetDepth(pixs)
        local out = ''
        local bit
        local storey = true
        local go
        GoodPoint[1] = 0
        for y=0,h-1 do
            out = ''
            storey = true
            for x=0,w-1 do
                bit = lua_pixGetPixel(pixs,x,y)
                if bit == 1 then
                    storey = false
                    break
                end
            end
            end
            if storey and (math.floor(0.5+ (y/res) *72.27*2^16)
                ~= GoodPoint[#GoodPoint]) then
```

```

        GoodPoint[#GoodPoint +1] = math.floor(0.5+ (y/res)
*72.27*2^16)
        end
        storey = true
    end
    GoodPoint[#GoodPoint +1] = math.floor(0.5+ (h/res) *72.27*2^16)
else
    tex.sprint("ERROR")
end
return GoodPoint
end

function document.lscarsos.LuaCollect(Fig,H,W,FigOpt)
    local H = math.floor(string.gsub(H,"pt","")*2^16)
    local W = math.floor(string.gsub(W,"pt","")*2^16)
    local vh = 0
    local h = step
    local S = ""
    local FigOpt = FigOpt or ""
    local NR = 0
    local Payload = ""
    local GoodPoint = document.lscarsos.GoodPoints or {}
    local j = 1
    local Vboxes = {}
    local prevvh = 0
    local truey = GoodPoint[#GoodPoint]
    local y_ratio = H / truey
    for i,v in ipairs(GoodPoint) do
        if GoodPoint[i+1] == nil then
            break
        end
        NR = NR + 1
        Vboxes[#Vboxes+1] = {from=v,to=GoodPoint[i+1],mark=NR}
    end
    Payload = "\\ruledvbox{\\hbox{\\clip[voffset=%dsp,width=%dsp,height=%dsp]
        {\\externalfigure[%s][%s]}}\\par\\nointerlineskip\\blank[1sp]"
    for i,v in ipairs(Vboxes) do
        S =string.format(Payload,y_ratio*v.from,W,y_ratio*(v.to-v.from),Fig,FigOpt)
        tex.sprint(tex.ctxcatcodes,S)
    end
end
end

```

3 MuPDF

We can replace the `pdftoppm` call by building a Lua binding to MuPDF, “a light-weight PDF viewer and toolkit written in portable C” (<http://www.mupdf.com>). Sumatra (http://en.wikipedia.org/wiki/Sumatra_PDF) is a fast pdfviewer based on MuPDF.

Despite MuPDF is a well written library and there are several examples that explain how to use it, it's not easy to write a converter.

What follow is only a part of an almost literal translation into Lua of the C program `pdfdraw.c` and even so the debugging is difficult.

```
function drawpbm(pagenum)
    local xref = pdfdraw.targetpdf.xref
    local drawrotate = pdfdraw.drawrotate
    local drawzoom = pdfdraw.drawzoom
    local drawbands = pdfdraw.drawbands
    local drawpattern= pdfdraw.drawpattern
    drawloadpage(pagenum)
    local drawpage = pdfdraw.drawpage
    local drawcache = pdfdraw.drawcache
    local bbox,w,h, bh
    local pix
    local fd,name
    name = pdfdraw.outname
    local ctm = mupdf.fz_identity()
    ctm = mupdf.fz_concat(ctm, mupdf.fz_translate(0, - drawpage.mediabox.y1))
    ctm = mupdf.fz_concat(ctm, mupdf.fz_scale(drawzoom, - drawzoom))
    ctm = mupdf.fz_concat(ctm, mupdf.fz_rotate(drawrotate + drawpage.rotate))
    bbox = mupdf.fz_roundrect(mupdf.fz_transformrect(ctm, drawpage.mediabox))
    w = bbox.x1 - bbox.x0;
    h = bbox.y1 - bbox.y0;
    bh = h / drawbands;
    if NotNil(drawpattern) then
        fd = io.open(name,'wb')
        if (fd == nil) then
            die(fz_throw("ioerror: could not create raster file '%s'", name));
        end
        fd:write(string.format("P4\n%d %d\n", w, h));
    end
    pix = mupdf.fz_newpixmap(mupdf.pdf_devicergb, bbox.x0, bbox.y0, w, bh)
    mupdf.fz_clearpixmap(pix, 0xFF);
    for b = 0, drawbands-1 do
        local dev, error
        dev = mupdf.fz_newdrawdevice(drawcache, pix)
```

```

error = mupdf.pdf_runcontentstream(dev, ctm, xref, drawpage.resources, drawpage.contents)
if (error>0) then
  die(fz_rethrow(error, "cannot draw page %d in PDF file '%s'", pagenum, basename))
end
mupdf.fz_freedevice(dev)
if NotNil(drawpattern) then
  for y = 0, pix.h -1 do
    local column = y * pix.w * 4
    local dst = {}
    local bit = 0
    local r = 0
    for x = 0, pix.w-1 do
      local v = (1+(mupdf.uti_samples_arr_getitem(pix.samples,(x * 4 + 1) +
column)))*77
      v = v + (1+(mupdf.uti_samples_arr_getitem(pix.samples,(x * 4 + 2) + column)))*150
      v = v + (1+(mupdf.uti_samples_arr_getitem(pix.samples,(x * 4 + 3) + column))*28
      v = math.floor(v/256)
      local d = 1
      if v > 200 then d = 0 end
      r = r + (d*2^(7-bit))
      bit = bit +1
      if bit == 8 then
        bit = 0
        dst[#dst+1] = string.char(r)
        r = 0
      end
    end
    if bit > 0 then
      dst[#dst+1] = string.char(r)
    end
    fd:write(table.concat(dst))
  end
end
pix.y = pix.y + bh;
if (pix.y + pix.h > bbox.y1) then
  pix.h = bbox.y1 - pix.y;
end
end
mupdf.fz_dropixmap(pix)
if NotNil(drawpattern) then
  fd:close()
end
drawfreepage()
print()
end

```

The complete binding is truly more difficult to debug: even if SWIG does an excellent work, it's necessary to manage the details of implementation of the library. In this case `pdftopbm` does already an excellent work, it's well tested, stable and ready to use; the call of an external program is not so expensive compared to a plug in.

4 Conclusion

Lua code is much nearer to plain standard Lua: ConTeXt offers some shortcuts that is better to learn. For example `math.floor(string.gsub("10pt", "pt", "")*2^16)` can be replaced by `string.todimen("10pt")` and possibly other things related to print.

The algorithm that finds a good breakpoint is rather simple: for example there are some unwanted good breakpoints between a Σ and its subscript. This leads to break an object that should not be broken even if it has some white rows inside. A practical solution is to consider a line with thickness greater than 1 pixel (but it's better to use metric dimensions).

These ideas are also valid for scanned text but then we must take care of noise (and Leptonica can help a lot here).

Finally, it's better to consider carefully the opportunity of a binding. As shown with MuPDF, sometimes the traditional way is still the best way.

About μ Talk

μ Talk is a short and technical paper that shows some unusual, hopefully useful, ideas following the schema "figure \rightarrow code". The main topic is always typographic programming in ConTeXt & Lua.