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A
Programa de ajuste dos expoentes

```perl
#!/usr/bin/perl
use strict;

use Statistics::LineFit;

my $datafile = @ARGV[0];

my (@xvalues, @yvalues);
my $y0;
my $found0 = 0;
my $total = -1;
my $windowsize = 10;
my $expmax = 0;
my $expmin = 10;

print "Abrindo arquivo de dados: $datafile...";
open (DATAFILE, "<$datafile") or
  die "Error openning data file $datafile: $!";
print "Ok.\n";

print "Lendo dados do arquivo...";
while (<DATAFILE>) {
  my $line = $_;

  chomp($line);
  #print "Lido: $line\n";
  $line =~ s/\s^//;
  $line =~ s/$\s//;
  $line =~ s/,/./g;

  my ($x, $y) = split(/\t/, $line);
```

```perl
  # Guarda o valor de rho0
  if ($x == 0) {
    if ($found0 == 0) {
      $y0 = $y;
      $found0 = 1;
      next;
    }
    else {
      next;
    }
  }


  # elimina pontos com y negativos e nulos
  next if ($y <= 0);


  # elimina pontos com y-y0 negativos e nulos
  next if (($y-$y0) <= 0);


  #print "x: $x, y: $y\n";
  @xvalues = (@xvalues, $x);
  @yvalues = (@yvalues, $y);

    system "echo \"with g0; s0 point $x, $y; \" > gracepipe";


  $total++;
}
system "echo \"with g0; autoscale yaxes; autoscale xaxes;
        redraw;\" > gracepipe";

print "Ok. $total pontos encontrados.\n";

if ($found0 == 0) {
  print "Aten\c{c}\~{a}o: valor de R(0) n\~{a}o encontrado. Prosseguindo
          assim mesmo.\n";
  $y0 = 0;
}


print "Ordenando os pontos em ordem crescente...";
my %data;
for (my $index = 0; $index <= $total; $index++) {
  $data{"$xvalues[$index]"} = $yvalues[$index];
}
```

```perl
@xvalues = sort {$a <=> $b} @xvalues;

@yvalues = ();
foreach my $value (@xvalues) {
  @yvalues = (@yvalues, $data{$value});
  #print "x: $value   y: $data{$value}\n";
}
print "Ok. \nVetor x possui $#xvalues pontos e vetor
       logy possui $#yvalues pontos.\n";

print "Calculando o logaritmo de x para cada ponto...";
my (@logx, @logy);
foreach my $x (@xvalues) {
  @logx = (@logx, &log10($x));
}
print "Ok.\n";

print "Calculando o logaritmo de y-y0 para cada ponto...";
foreach my $y (@yvalues) {
  @logy = (@logy, &log10($y-$y0));
}
print "Ok.\n";

print "Desenhando o gr\'{a}fico log(R-R0) x log(T)...";
for (my $index = 0; $index <= $total; $index++) {
  system "echo \"with g1; s0 point $logx[$index],
          $logy[$index];  \" > gracepipe";
}
system "echo \"with g1; autoscale yaxes; autoscale
        xaxes; redraw;\" > gracepipe";
print "Ok.\n";

print "Realizando a regress\~{a}o linear em janelas de
        $windowsize pontos:\n";

my  $lineFit = Statistics::LineFit->new();

my $windowstart = 0;
my $windowend = $windowsize;
my @b_data = ();
my @r2_data = ();
```

```perl
while ($windowend <= $total) {

  last if ($windowstart > ($windowend-3));

  my @windowxdata = ();
  my @windowydata = ();

  #L\^{e} os dados da janela e os grava nos vetores da janela
  for (my $index = $windowstart; $index <= $windowend; $index++) {
    @windowxdata = (@windowxdata, $logx[$index]);
    @windowydata = (@windowydata, $logy[$index]);
  }

  $lineFit->setData (\@windowxdata, \@windowydata) or die "Invalid data";

  my ($intercept, $slope) = $lineFit->coefficients();
  defined $intercept or die "Can't fit line if x values are all equal";
  my $rSquared = $lineFit->rSquared();

  # Finds maximum exponent
  if ($slope > $expmax) {
    $expmax = $slope;
  }

  # Finds minimum exponent
  if ($slope < $expmin) {
    $expmin = $slope;\begin{program}
  }

  #Grava os dados encontrados em vetores apropriados
  for (my $index = $windowstart; $index <= $windowend; $index++) {
    $b_data[$index] = $slope;
    $r2_data[$index] = $rSquared;

    # plota o expoente no gr\'{a}fico 2
    system "echo \"with g2; s0 point $xvalues[$index],
            $slope;  \" > gracepipe";

    # plota a fun\c{c}\~{a}o fitada de volta no gr\'{a}fico 1
    my $yfit = $intercept + $slope * $logx[$index];
    system "echo \"with g1; s1 point $logx[$index],
```

```
            $yfit;  \" > gracepipe";


  }
  system "echo \"with g2; autoscale yaxes;
          autoscale xaxes; redraw;\" > gracepipe";
  system "echo \"with g1; autoscale yaxes;
          autoscale xaxes; redraw;\" > gracepipe";


  $intercept = sprintf("%6.3f", $intercept);
  $rSquared = sprintf("%6.3f", $rSquared);
  $slope = sprintf("%6.3f", $slope);


  print "inicio: ($windowstart) $xvalues[$windowstart] fim: ($windowend)
          $xvalues[$windowend] a: $intercept   b: $slope    r2: $rSquared \n";


  #$windowsize = 20 if ($xvalues[$windowend] <= 4);
  #$windowsize = 5 if (($xvalues[$windowend] > 4)
    and (($xvalues[$windowend] <= 50)));
  #$windowsize = 9 if ($xvalues[$windowend] > 4);


  $windowstart = $windowend +1;
  $windowend = $windowstart + $windowsize;
  if ($windowend > $total) {
    $windowend = $total;
  }


  last if ($windowstart == $total);
}
print "Fim da regress\~{a}o.\n";

my $worldstart = 0;
my $worldend = 20;
my $logworldstart = 0; #log10($worldstart);
my $logworldend = &log10($worldend);
my $major = ($worldend-$worldstart) / 10;
my $minor = ($worldend-$worldstart) / 20;
my $logmajor = ($logworldend - $logworldstart) / 10;
my $logminor = ($logworldend - $logworldstart) / 20;

system "echo \"with g0; world $worldstart,0,
        $worldend,0.007; xaxis tick major $major;
        xaxis tick minor $minor; autoscale yaxes;
```

```
        redraw;\" > gracepipe";
system "echo \"with g1; world $logworldstart,0,
        $logworldend,2; xaxis tick major $logmajor;
        xaxis tick minor $logminor; autoscale yaxes;
        redraw;\" > gracepipe";
system "echo \"with g2; world $worldstart,0,$worldend,2;
        xaxis tick major $major; xaxis tick minor $minor;
        redraw;\" > gracepipe";


close (DATAFILE);


$datafile = $datafile . '.out';
print "Abrindo arquivo sa\'{i}da de dados: $datafile...";
open (OUTDATAFILE, ">$datafile") or
  die "Error openning data file $datafile: $!";
print "Ok.\n";


for (my $index = 0; $index <= $total; $index++) {

  $expmax = 2;
  $expmin = 0;
  my $colorcode = 0; # black for everything

  if (($b_data[$index] < $expmax)
      and ($b_data[$index] > $expmin)) {
    #my $expnorm = ($b_data[$index] - $expmin) / ($expmax-$expmin);

    #my $r = int($expnorm * 256);
    my $k = &gauss(2, 0.08, $b_data[$index]);
    my $r = int($k*255);

    my $l = &gauss(1.5, 0.08, $b_data[$index]);
    my $g = int($l*255);

    my $m = &gauss(1, 0.08, $b_data[$index]);
    my $b = int($m*255);

    #print "b: $b_data[$index] k: $k r $r l: $l g: $g m: $m b: $b \n";

    $colorcode = $r + int($g*256) + int($b*65536);
  }
```

```perl
    my $a = sprintf("%6.3f", $xvalues[$index]);
    my $b = sprintf("%9.6f", $yvalues[$index]);
    my $c = sprintf("%9.6f", $logx[$index]);
    my $d = sprintf("%9.6f", $logy[$index]);
    my $e = sprintf("%6.3f", $b_data[$index]);
    my $f = sprintf("%6.3f", $r2_data[$index]);
    my $g =  $colorcode;
    print OUTDATAFILE "$a\t$b\t$c\t$d\t$e\t$f\t$g\n"
}


close OUTDATAFILE;

sub log10 {
  my $n = shift;
  return log($n)/log(10);
}


sub gauss {
  my ($center, $width, $x) = @_;


  return exp((-1*($x-$center)**2) / (2*$width));
}
```