Tiling Visualizer

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with help from:

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Roadmap

What is loop tiling?

What is the Tiling Visualizer?

What are the limitations?
What is this tool?

T-Vis renders rectangular tilings of 2D polyhedral loops.

Tiling is a loop transformation for optimization.

T-Vis images are useful for papers and in explaining tiling in a classroom setting.
Intro to tiling

Matrix vector multiply:

\[
\begin{bmatrix}
    a_{00} & a_{01} & \cdots & a_{0(n-1)} \\
    a_{10} & a_{11} & \cdots & a_{1(n-1)} \\
    \vdots & \vdots & \ddots & \vdots \\
    a_{(n-1)0} & a_{(n-1)1} & \cdots & a_{(n-1)(n-1)}
\end{bmatrix} \cdot
\begin{bmatrix}
    b_0 \\
    b_1 \\
    \vdots \\
    b_{(n-1)}
\end{bmatrix} =
\begin{bmatrix}
    c_0 \\
    c_1 \\
    \vdots \\
    c_{(n-1)}
\end{bmatrix}
\]

for (i=0; i<N; i++)

for (k=0; k<N; k++)

\[c[i] += a[i,k] \times b[k];\]
Tiled Matrix-Vector Multiply:

for (jT=0; jT<N; jT+=2)
for (kT=0; kT<N; kT+=2)
for (j=jT; j<min(jT+2,N); j++)
for (k=kT; k<min(kT+2,N); k++)
c[j] += a[j,k] * b[k];
# Insets & Outsets

<table>
<thead>
<tr>
<th>Inset</th>
<th>Outset</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tile origins within the inset are all full tiles</td>
<td>All tile origins for points in the iteration space are in the outset</td>
</tr>
</tbody>
</table>

### Calculation\(^1\)

<table>
<thead>
<tr>
<th>Calculation(^1)</th>
<th>Calculation(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift all upper bounds in along their normal by a value related to the tile size</td>
<td>Shift all lower bounds out along their normal by a value related to the tile size</td>
</tr>
</tbody>
</table>

\(^1\) There is a better explanation of this in M.Strout's LCPC'07 paper
Example
Example
A Little Motivation

Before T-Vis

Tiling diagrams drawn by hand

Time consuming to adjust

Not very uniform in style

Diagram borrowed from M.Strout's LCPC'07 paper
Features

Input

Simple text file
CLooG-style matrix & additional markup for tiling
[Example]

Output

svg, pdf, png, jpeg or tiff of the tiling

Open Source – NewBSD License
Live Demo

There is a terminal version and a GUI!
Limitations

2d iteration space
rectangular tiles
no legend yet
requires Java 1.6.0_7 or later
Where can I find it?

www.cs.colostate.edu/~roelofs/

Questions?

Sources:

Parameterized Tiled Loops for Free, Strout – PLDI'07
Example

```vim
1 # Starting coordinates of the point field
2 # startX startY
3 0 0
4
5 # Ending X Y coordinate of the point field
6 # endX endY
7 25 20
8
9 # Size of the rectangular tile
10 # must be positive and nonzero
11 # width height
12 3 3
13
```
T-Vis uses Apache's Batik for rendering

- http://xmlgraphics.apache.org/batik/

- Batik renders operations done on a Java Graphics2D object to SVG

- SVG document is then converted to the requested output format