Idea on Redistribution Algorithms

Young Won Lim
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Please send corrections (or suggestions) to youngwlim@hotmail.com.

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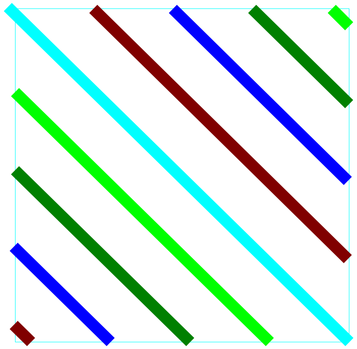
Circulant Matrix



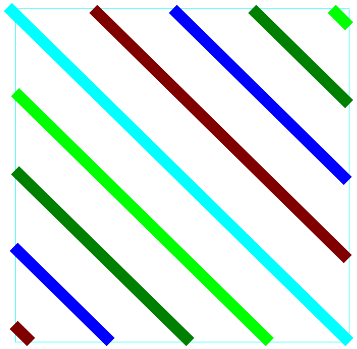
Cyclic(x) → Cyclic(Kx) data redistribution problem

Destination Processor Table

(i * j) mod N

Log N steps

DFT Matrix Example



$$e^{-j\left(\frac{2\pi}{N}\right)kn} \in \left\{ e^{-j\left(\frac{2\pi}{N}\right)0},\ e^{-j\left(\frac{2\pi}{N}\right)1},\ e^{-j\left(\frac{2\pi}{N}\right)2}, \cdots,\ e^{-j\left(\frac{2\pi}{N}\right)(N-1)} \right\}$$

(i + j) mod N

Log N steps

Butterfly Computation

Data Redistribution Algorithms using a Circulant Matrix

Explore possible Log steps
in various cases of data redistributions

- FFT
- Parallel Prefix Sum

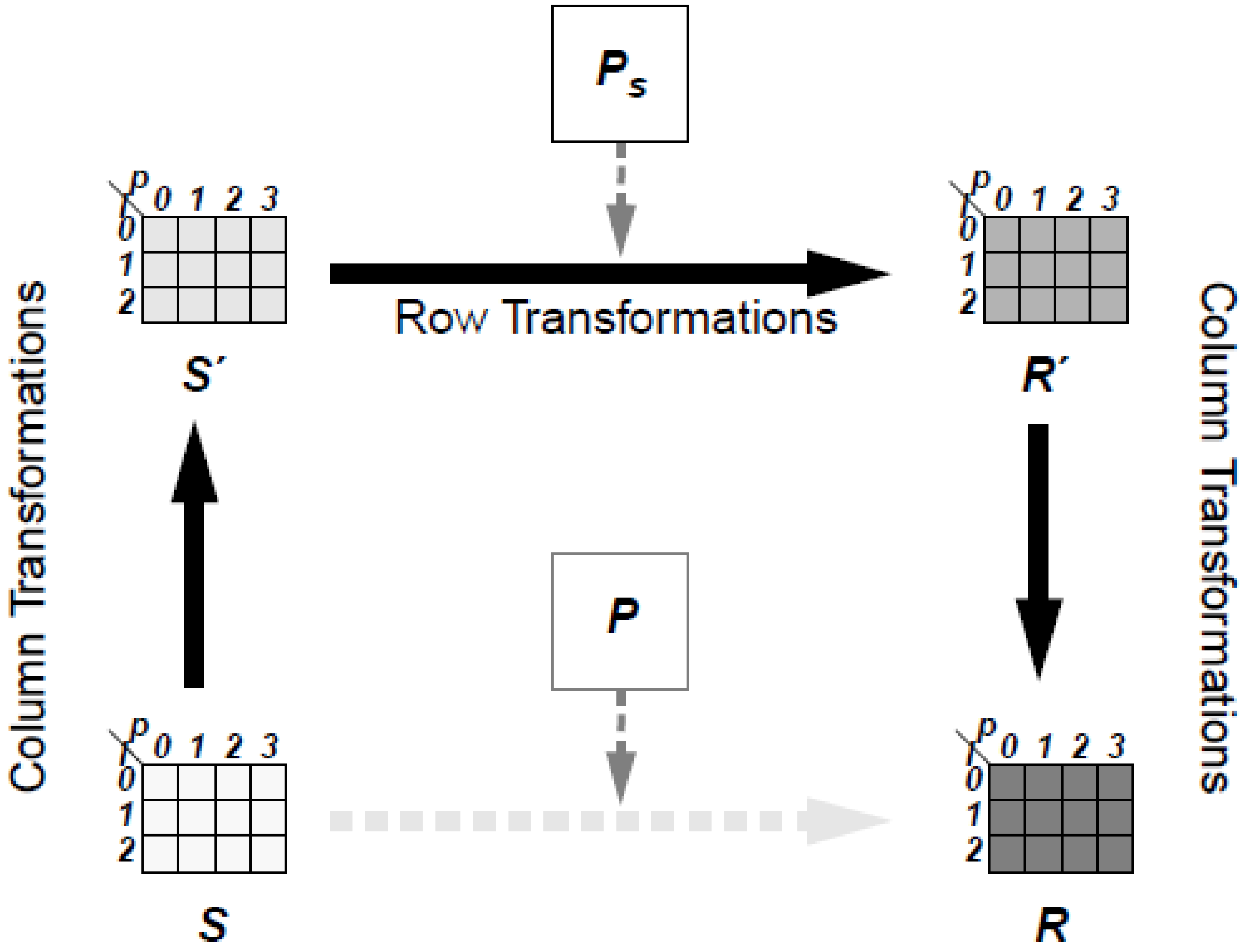
using rule based search

- Haskell Funcitonal Programming
- Prolog Logic Programming

Find link between

- General Circulant Matrix based Algorithms
- Tensor Product based FFT Algorithms
- Radix based FFT Algorithms

Based on

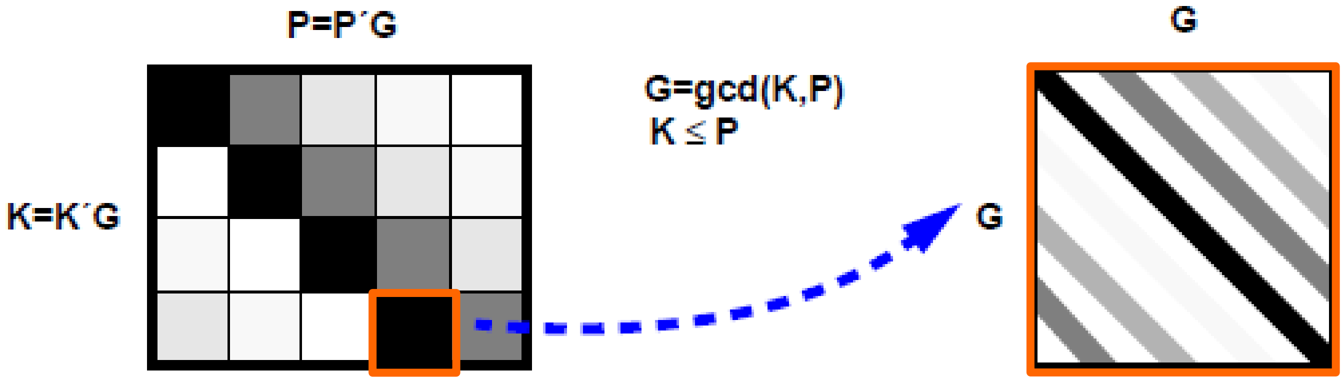


Y. W. Lim, "Efficient algorithms for block-cyclic redistribution of arrays", Alogrithmica, 1999

Based on

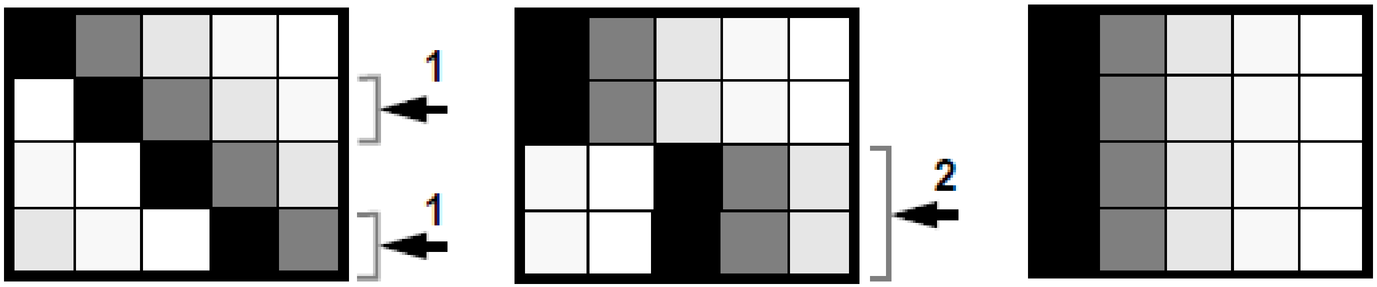
Generalized Circulant Matrix

Recursive Circulant Matrix



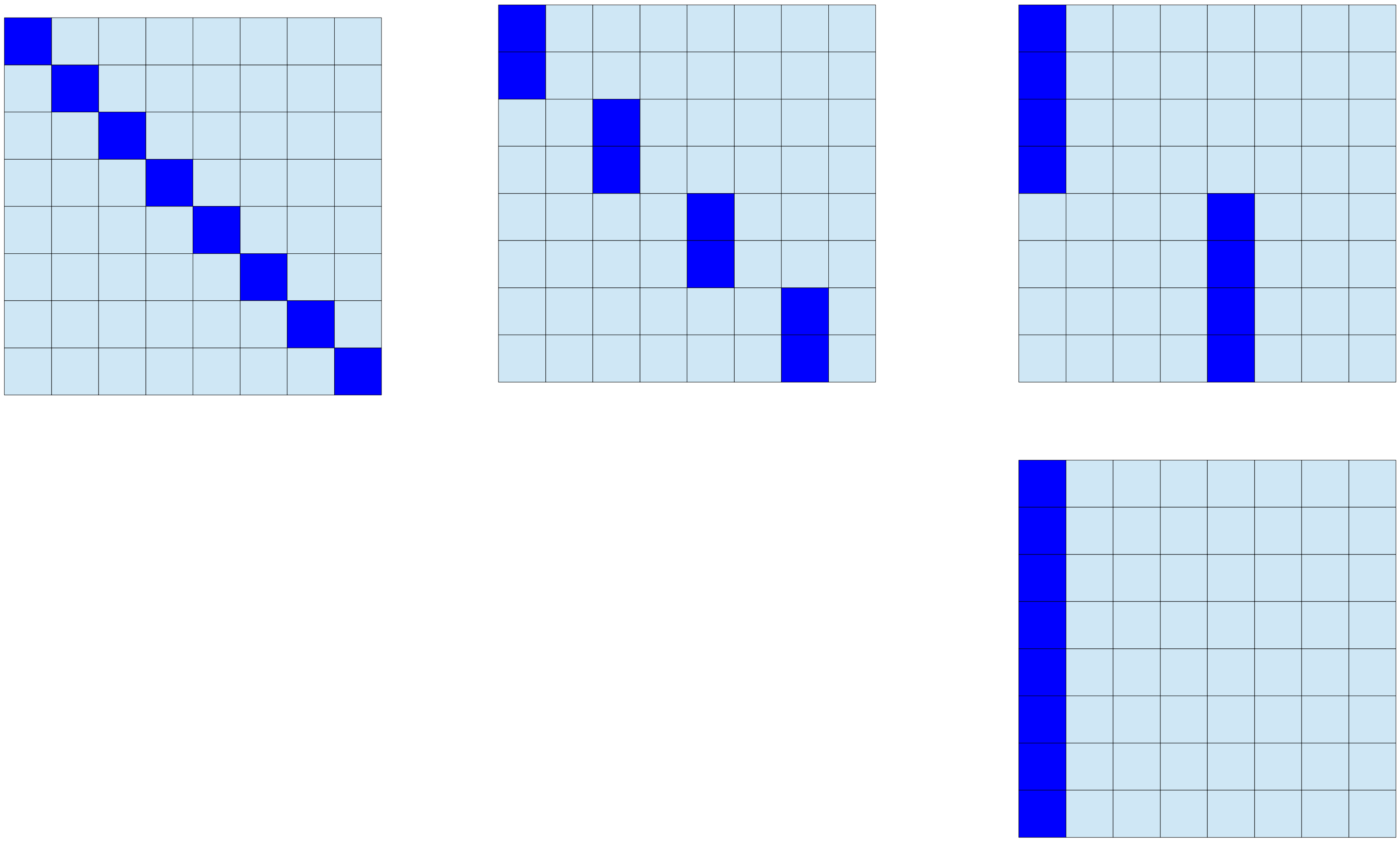
(a)

(b)



Y. W. Lim, "Efficient algorithms for block-cyclic redistribution of arrays", Alogrithmica, 1999

Finding Haskell / Prolog Rules to align diagonals



Applying Sudoku Solver Rules

Thinking Functionally with Haskell, R. Bird

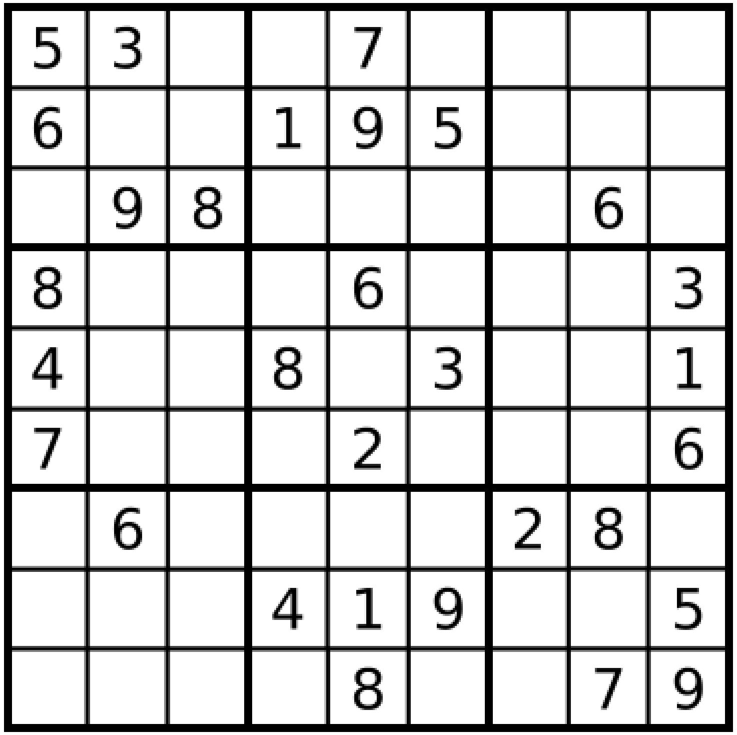
https://wiki.haskell.org/Sudoku

http://cdsoft.fr/haskell/sudoku.html

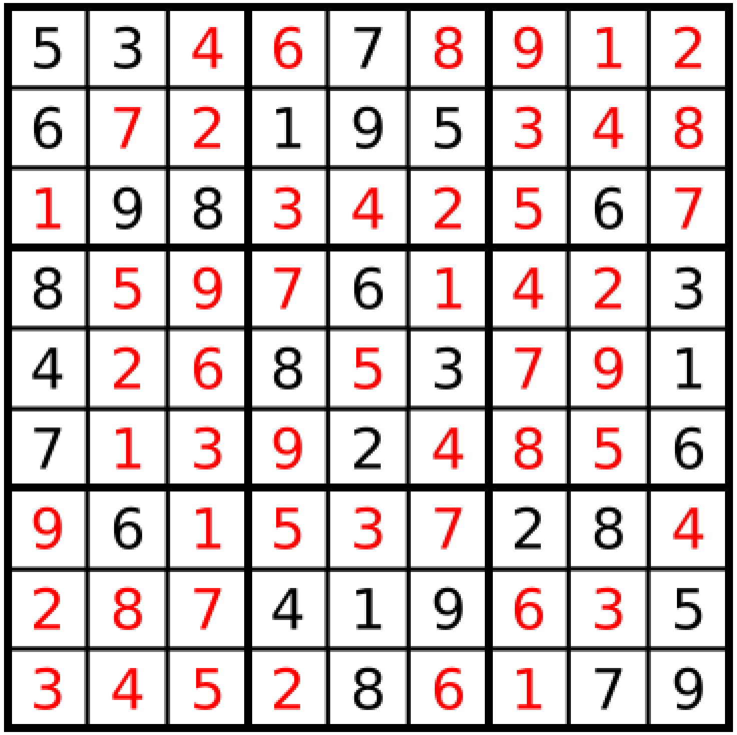
https://gist.github.com/wvandyk/3638996

http://www.cse.chalmers.se/edu/year/2015/course/TDA555/lab3.html

Sudoku



5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9



5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

https://en.wikipedia.org/wiki/Sudoku

Applying Sudoku Solver Rules

FFTW + Spiral Project of CMU

https://users.ece.cmu.edu/~franzf/papers/amast08.pdf

Mixed Radix FFT Algorithms

Based on

Based on

Based on

References

[1] http://en.wikipedia.org/

[2] Y. W. Lim, "Efficient algorithms for block-cyclic redistribution of arrays", Alogrithmica, 1999