

Hypercube, auto-picking, and QCing

Robert G. Clapp

Motivation

Motivation

Dynamic
Programming

Lloyd

Hypercube

- ✦ Interpretation guided by computation
- ✦ Computation guided by interpretation

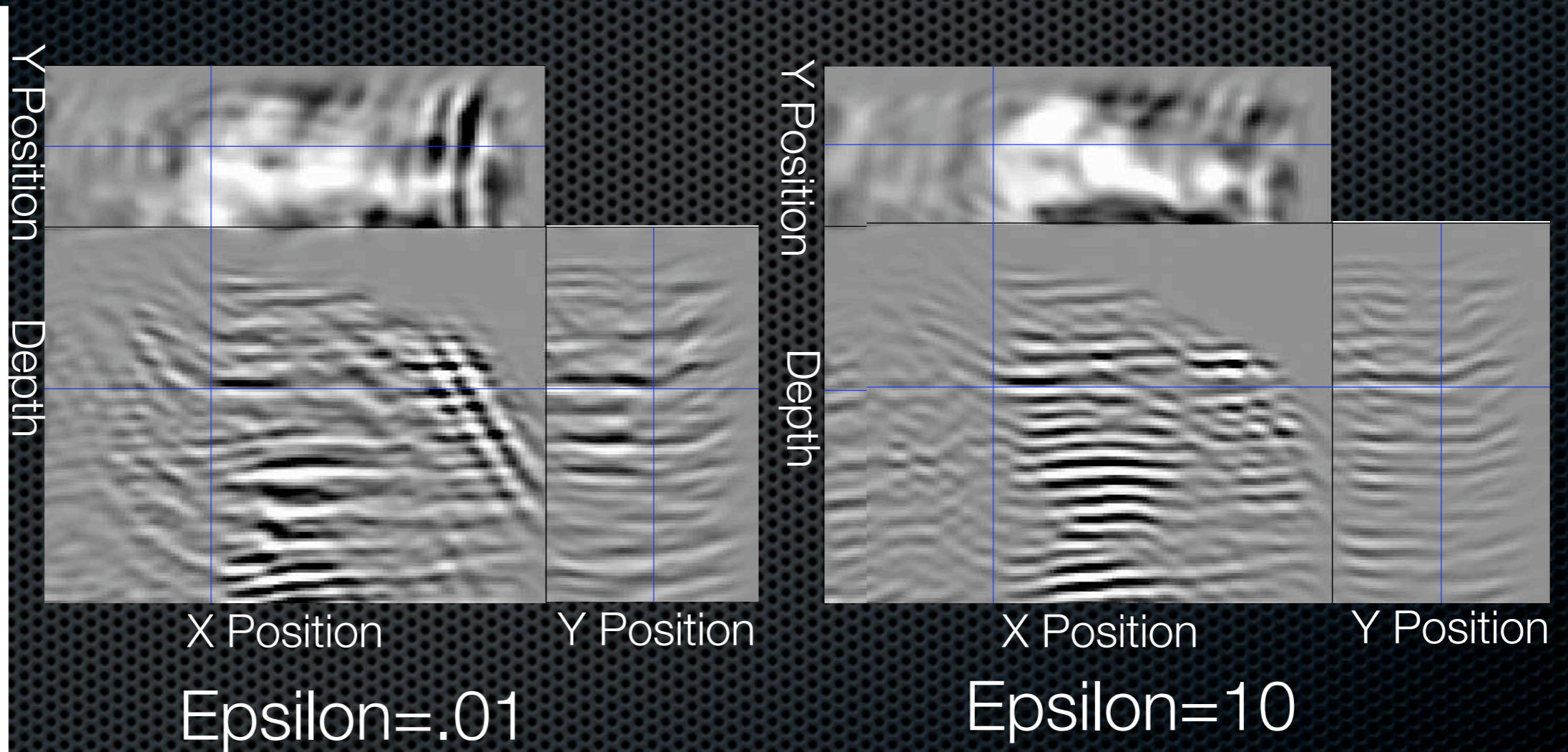
Inversion imaging: Space variable epsilon

Motivation

Dynamic Programming

Lloyd

Hypercube



Valenciano(2008)

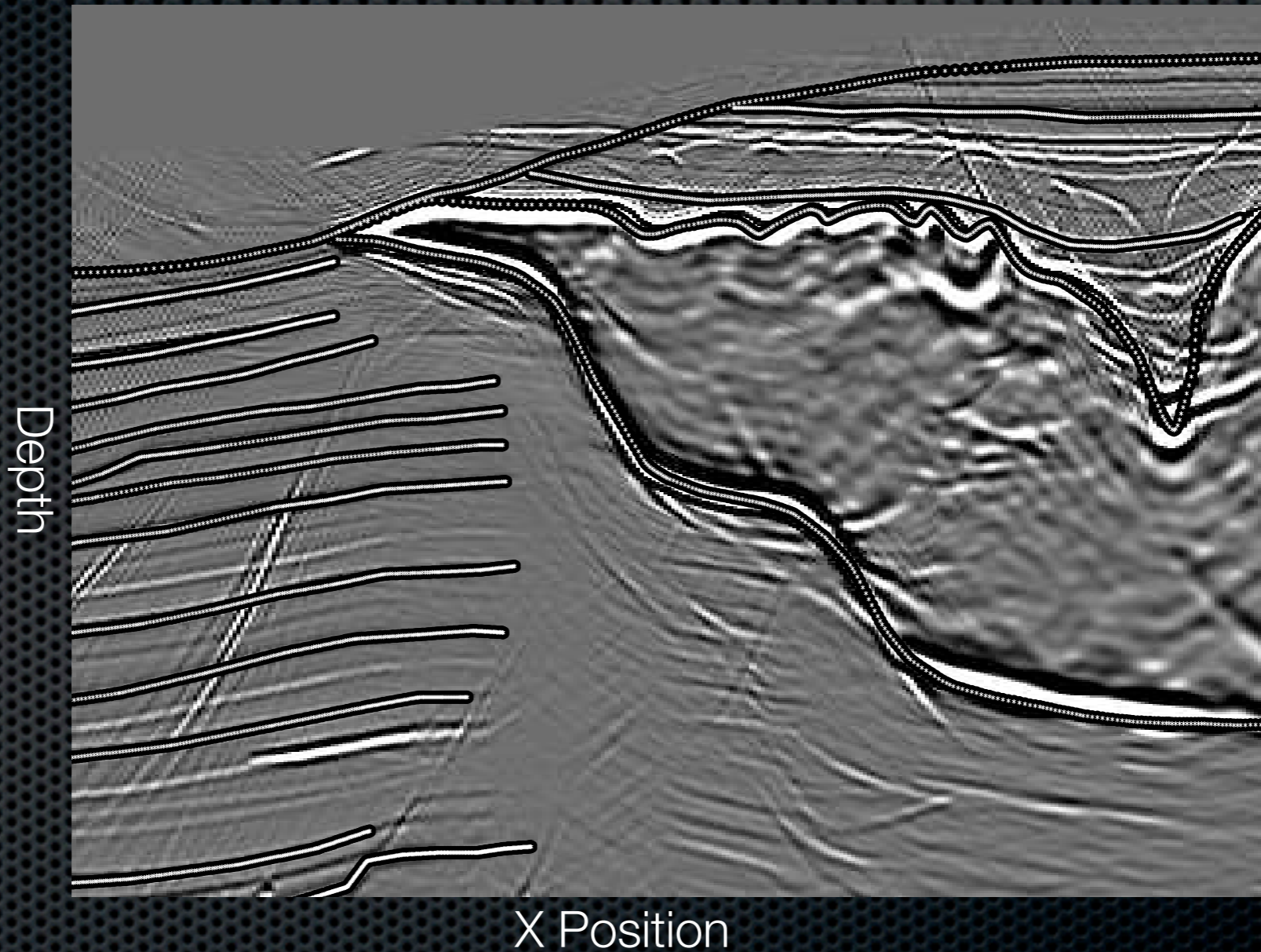
Inverse imaging: Geologic regularization

Motivation

Dynamic
Programming

Lloyd

Hypercube



Clapp(2005)

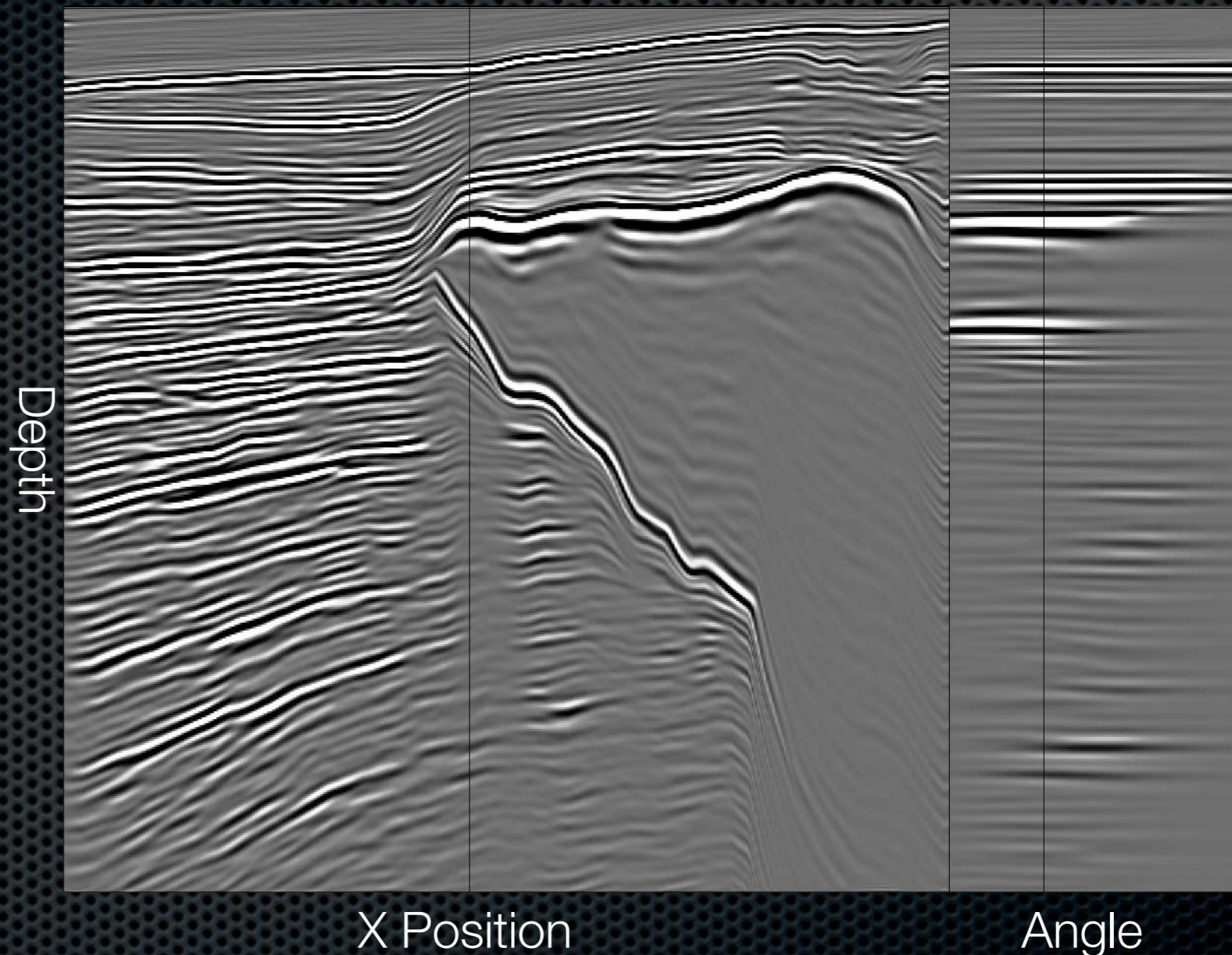
Inverse imaging: Geologic regularization

Motivation

Dynamic Programming

Lloyd

Hypercube



Clapp(2005)

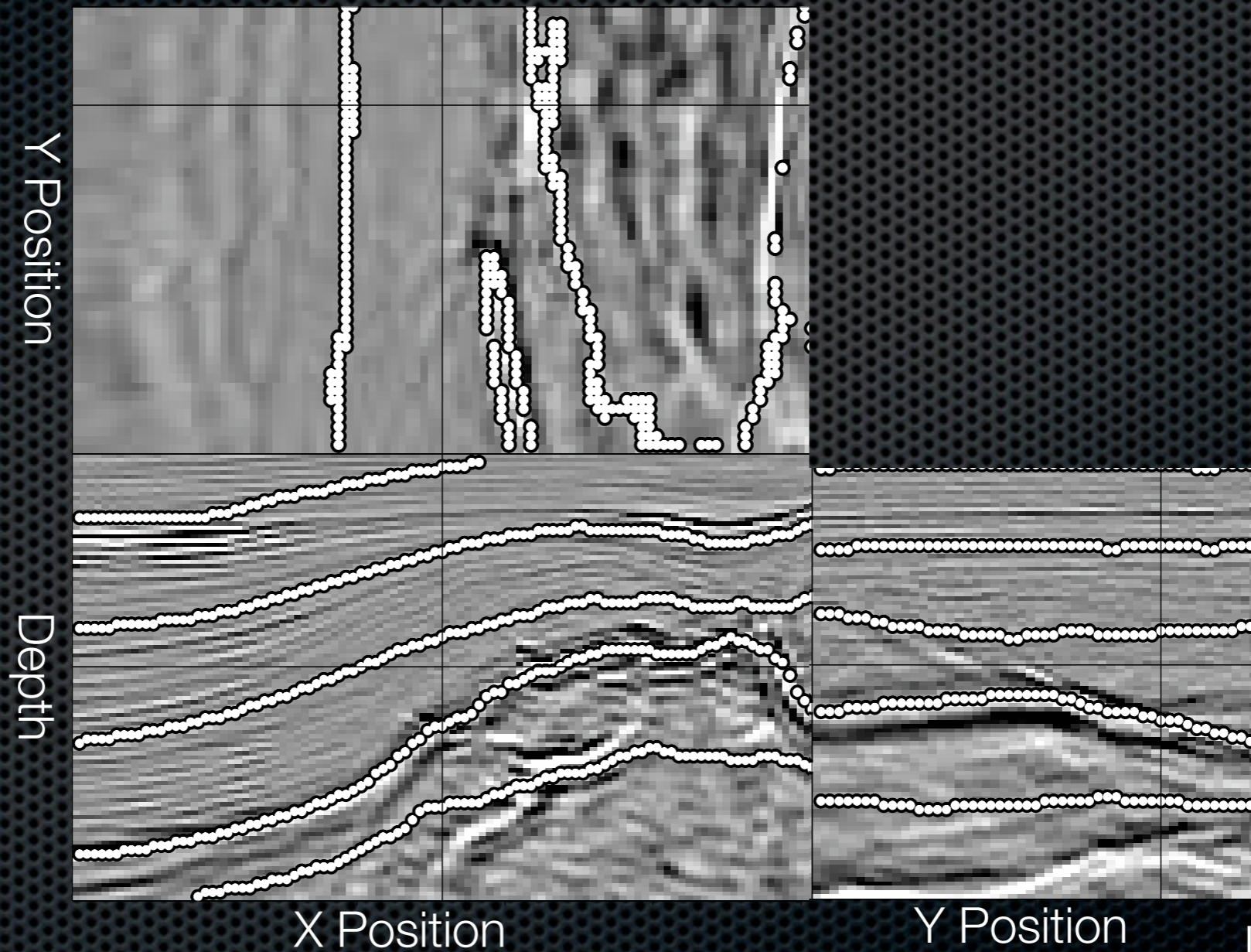
Flattening: Interpretation and picking

Motivation

Dynamic Programming

Lloyd

Hypercube



Lomask(2006)

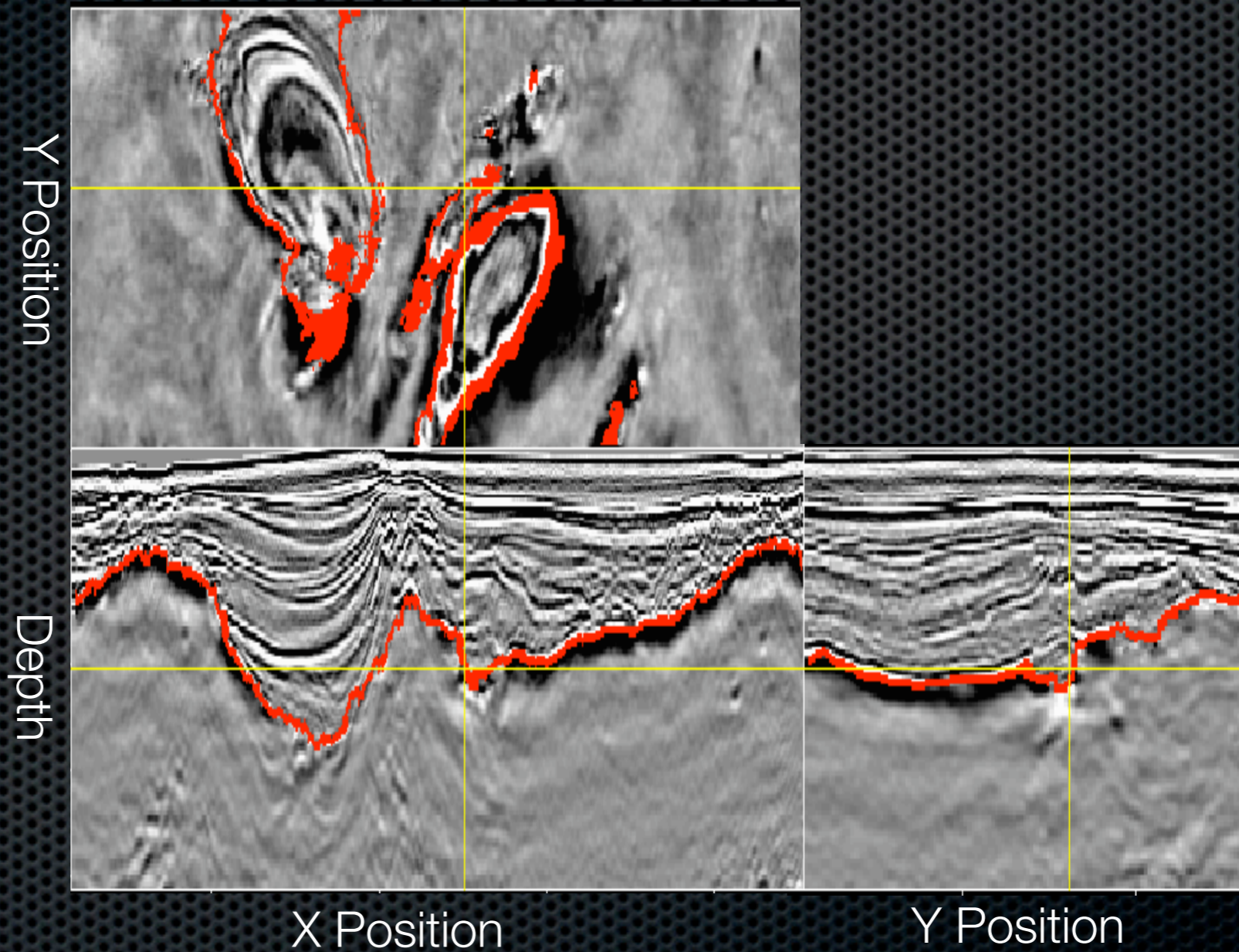
Segmentation: Salt bodies

Motivation

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Lloyd

Hypercube



Lomask(2006)

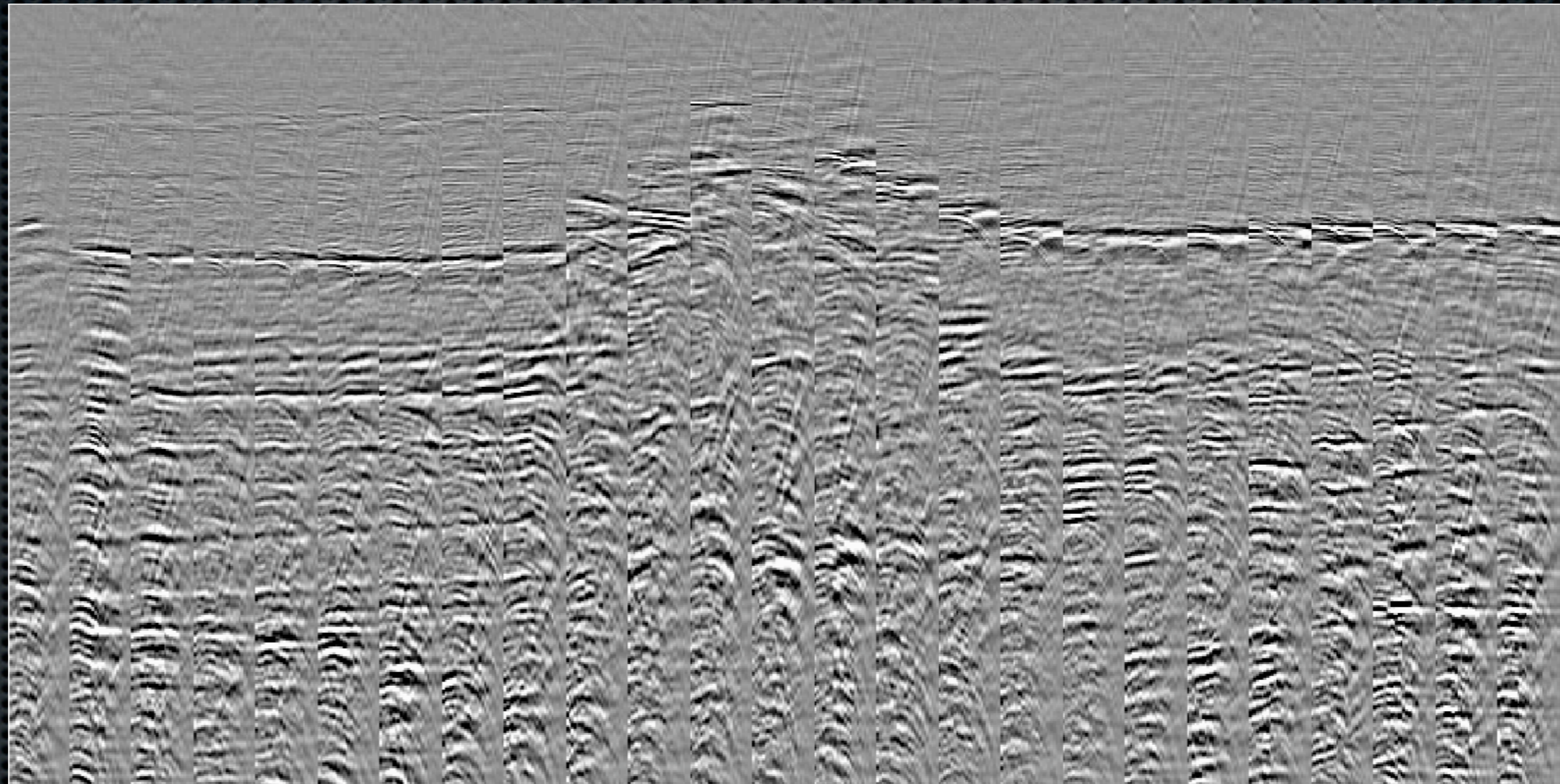
Tomography

Motivation

Dynamic
Programming

Lloyd

Hypercube



How we've avoided the problem

Motivation

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Hypercube

- ✦ Invented schemes to avoid the interactive nature of the problem
- ✦ Struggled through producing a single example
- ✦ Mention that it would be a good idea and move on

Hypercube

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Hypercube

- ✦ A replacement for the Ricksep viewing program
- ✦ An interface for merging computation with interpretation

Outline

Motivation

Dynamic
Programming

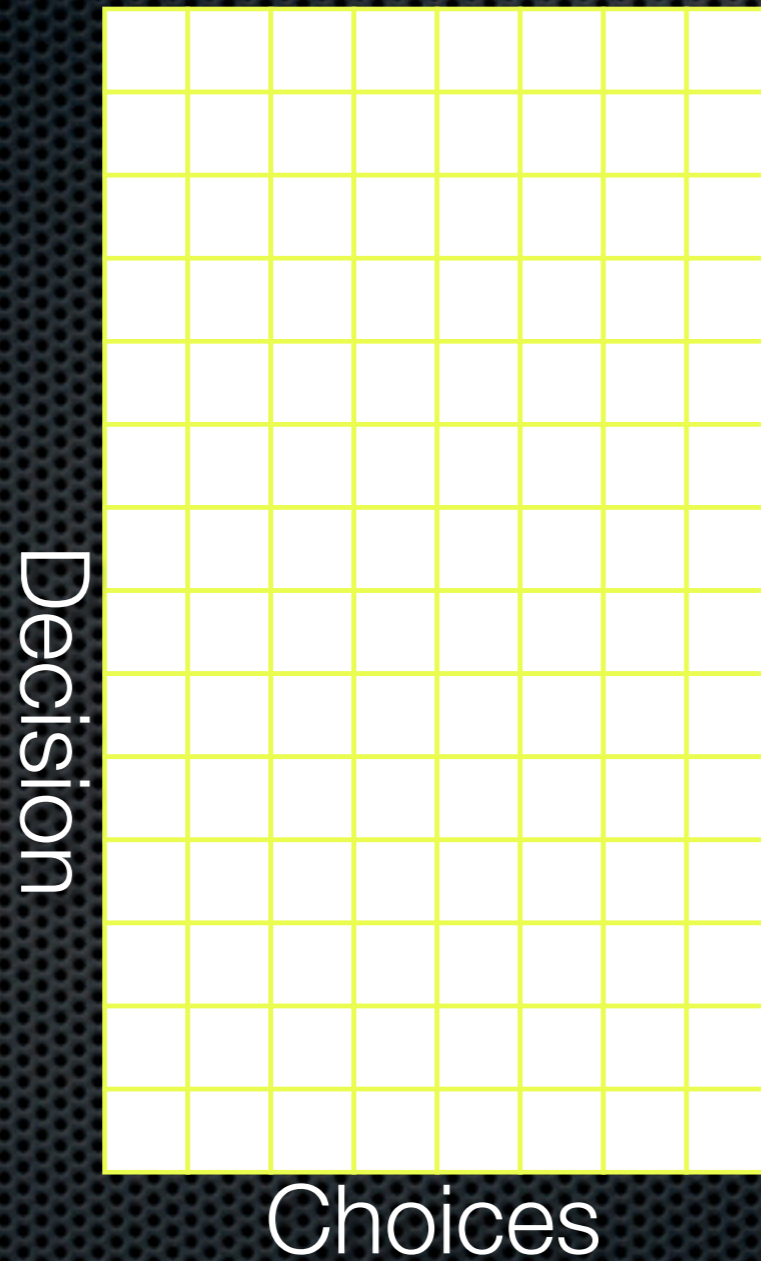
Lloyd

Hypercube

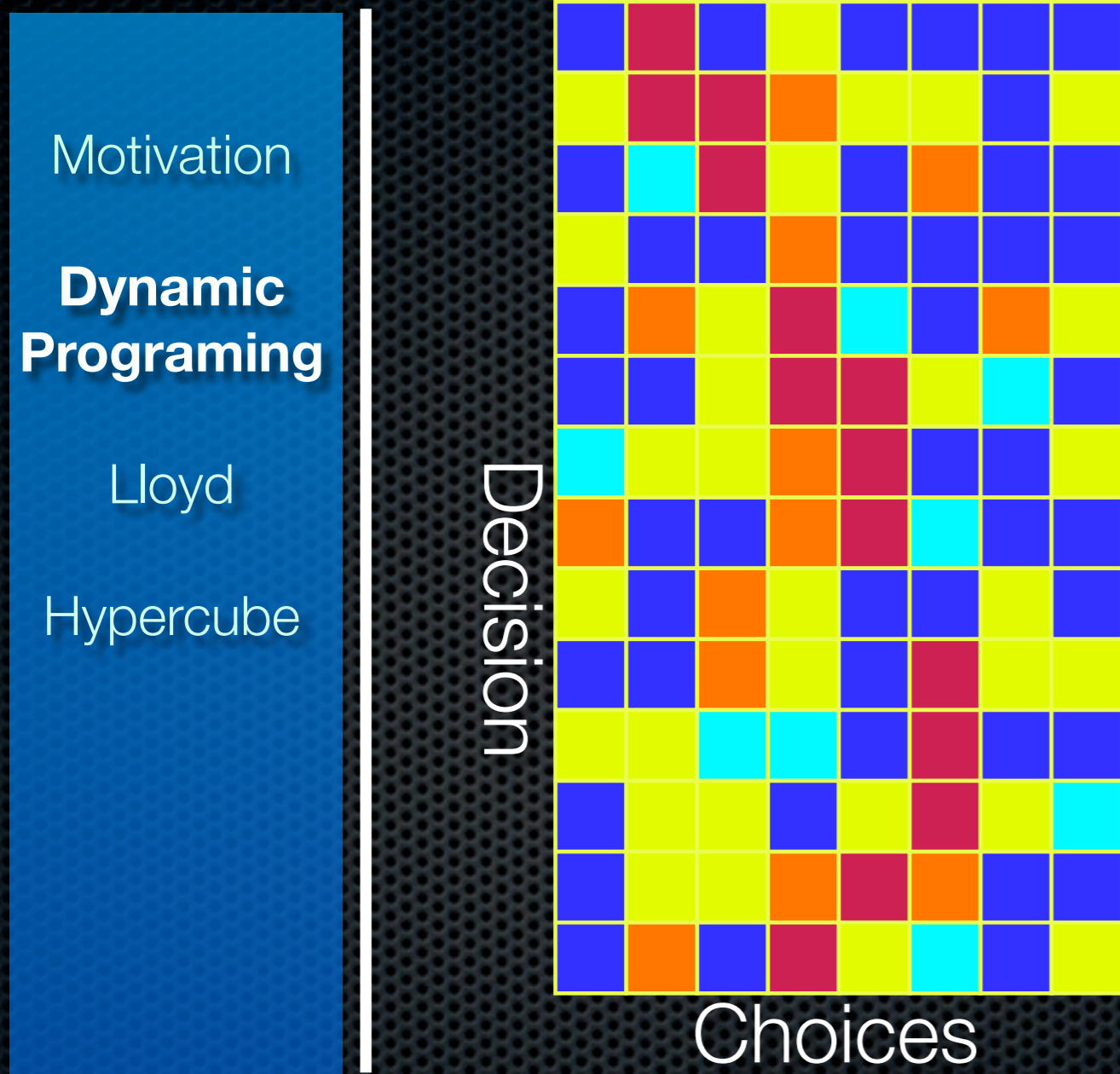
- ✦ Dynamic programming and autopicking
- ✦ Lloyd's algorithm and QCing
- ✦ Hypercube demo

Dynamic Programming overview

Motivation
Dynamic Programming
Lloyd
Hypercube



Relative quality



Similarity matrix

Motivation
**Dynamic
Programming**
Lloyd
Hypercube

Decision

0	4	0	2	0	0	0	0
2	4	4	3	2	2	0	2
0	1	4	2	0	3	0	0
2	0	0	3	0	0	0	0
0	3	2	4	1	0	3	2
0	0	2	4	4	2	1	0
1	2	2	3	4	0	0	2
3	0	0	3	4	1	0	0
2	0	3	2	0	0	2	0
0	0	3	2	0	4	2	2
2	2	1	1	0	4	0	0
0	2	2	0	2	4	2	1
0	2	2	3	4	3	0	0
0	3	0	4	2	1	0	2

Choices

Score matrix

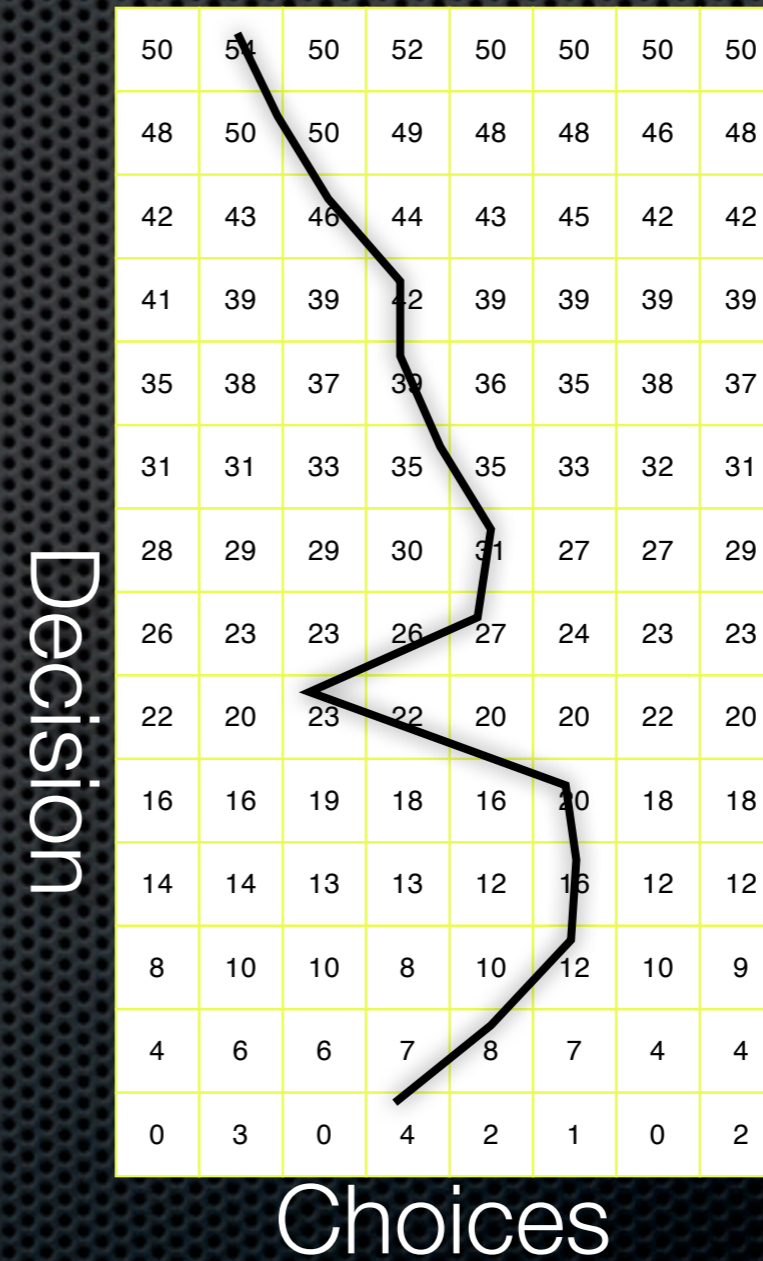
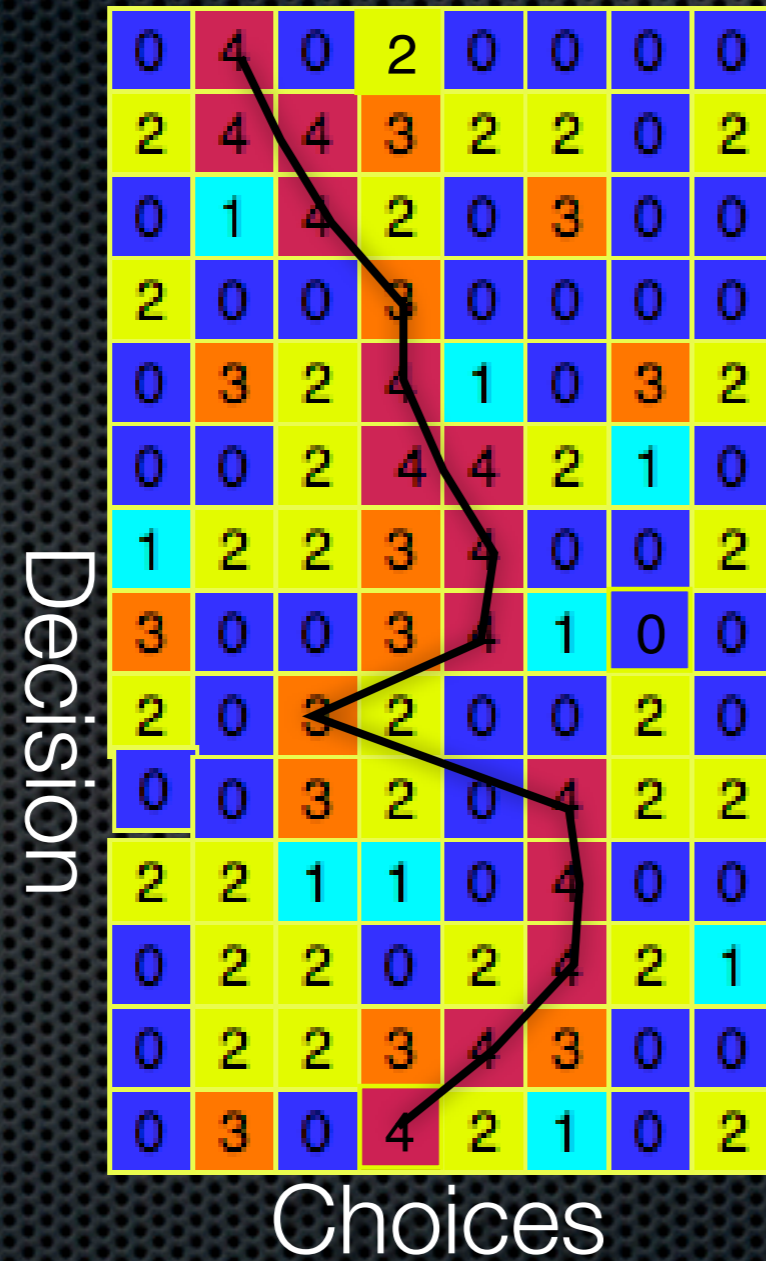
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Decision	0	4	0	2	0	0	0	0
	2	4	4	3	2	2	0	2
	0	1	4	2	0	3	0	0
	2	0	0	3	0	0	0	0
	0	3	2	4	1	0	3	2
	0	0	2	4	4	2	1	0
	1	2	2	3	4	0	0	2
	3	0	0	3	4	1	0	0
	2	0	3	2	0	0	2	0
	0	0	3	2	0	4	2	2
	2	2	1	1	0	4	0	0
	0	2	2	0	2	4	2	1
	0	2	2	3	4	3	0	0
	0	3	0	4	2	1	0	2
Choices								

Decision	50	54	50	52	50	50	50	50
	48	50	50	49	48	48	46	48
	42	43	46	44	43	45	42	42
	41	39	39	42	39	39	39	39
	35	38	37	39	36	35	38	37
	31	31	33	35	35	33	32	31
	28	29	29	30	31	27	27	29
	26	23	23	26	27	24	23	23
	22	20	23	22	20	20	22	20
	16	16	19	18	16	20	18	18
	14	14	13	13	12	16	12	12
	8	10	10	8	10	12	10	9
	4	6	6	7	8	7	4	4
	0	3	0	4	2	1	0	2
Choices								

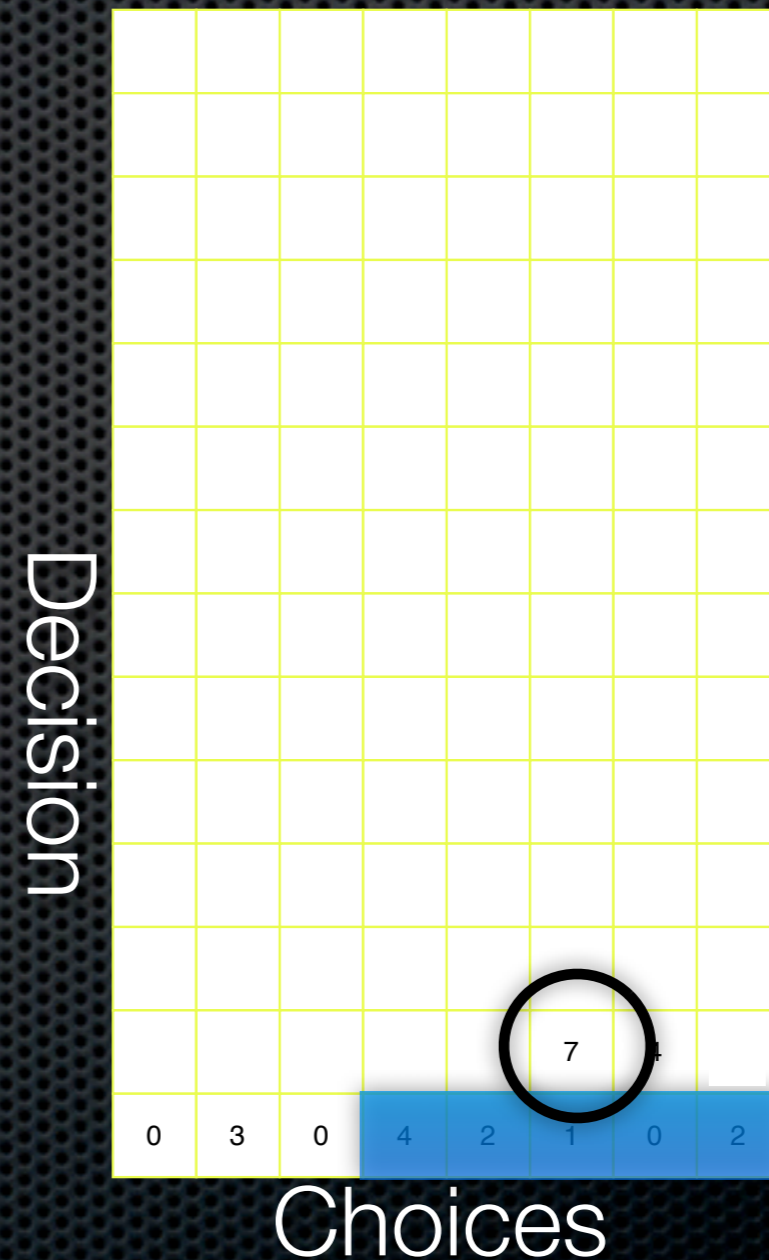
Trace back

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Limit search radius

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Limit search radius

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Dynamic Programming
Lloyd
Hypercube



Semblance picking

Motivation

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Decision



Choices

Semblance picking

Motivation

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Time



Velocity

Semblance picking: Nails

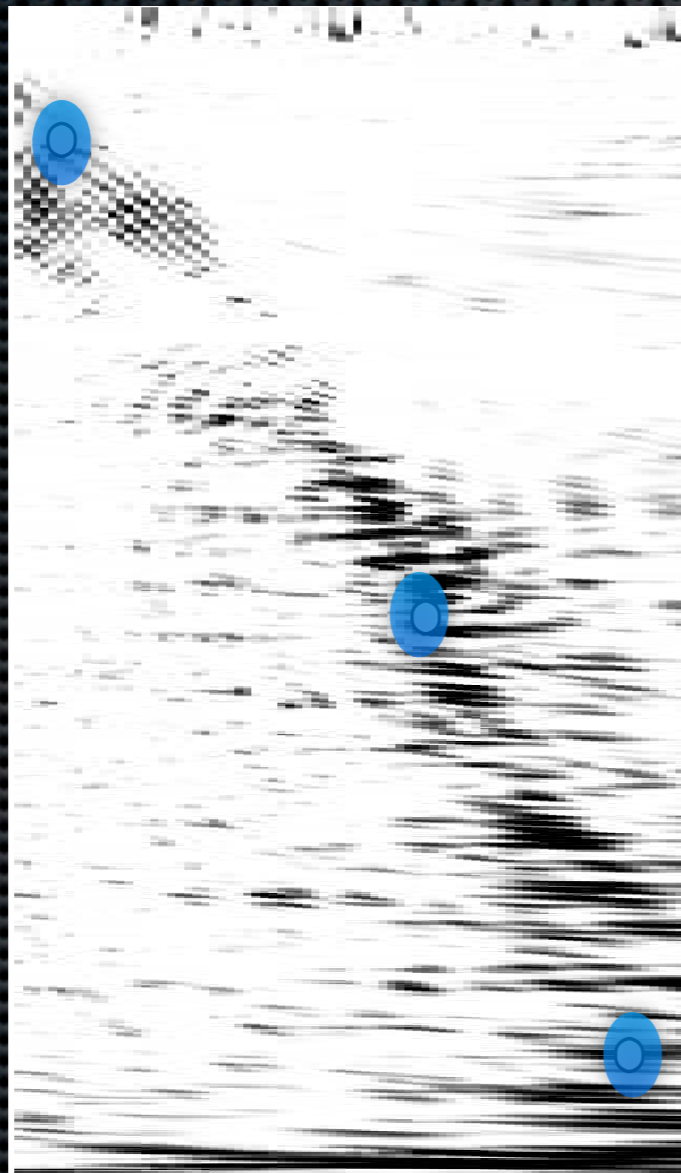
Motivation

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Time



Velocity

Linear path

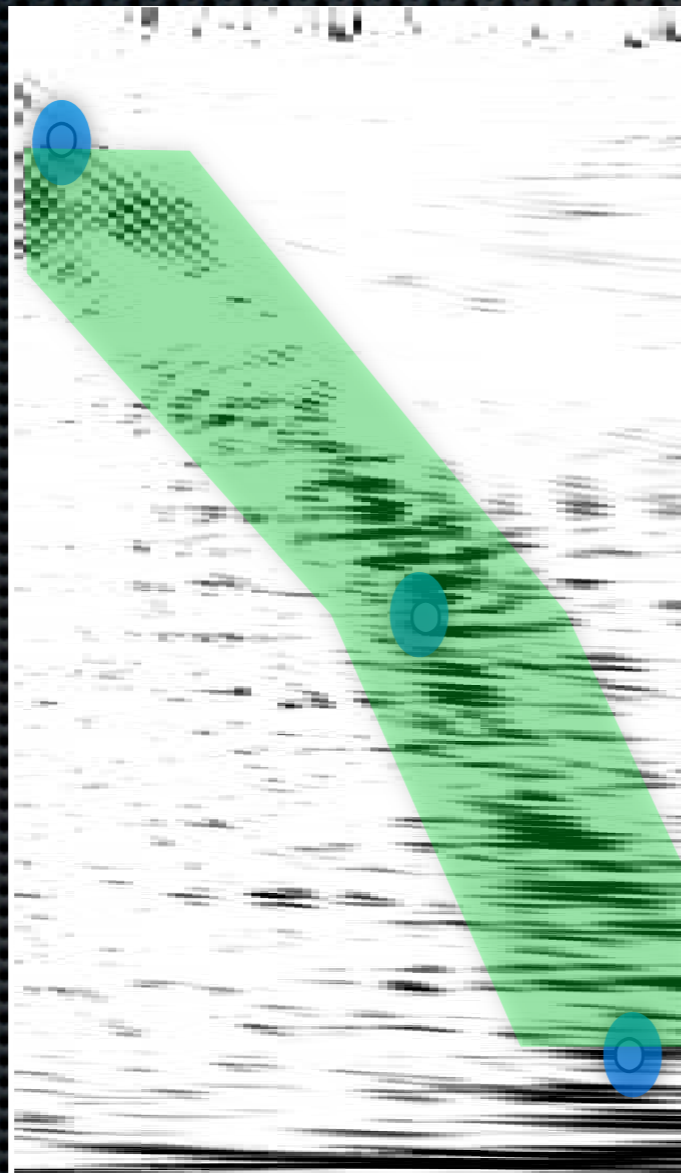
Motivation

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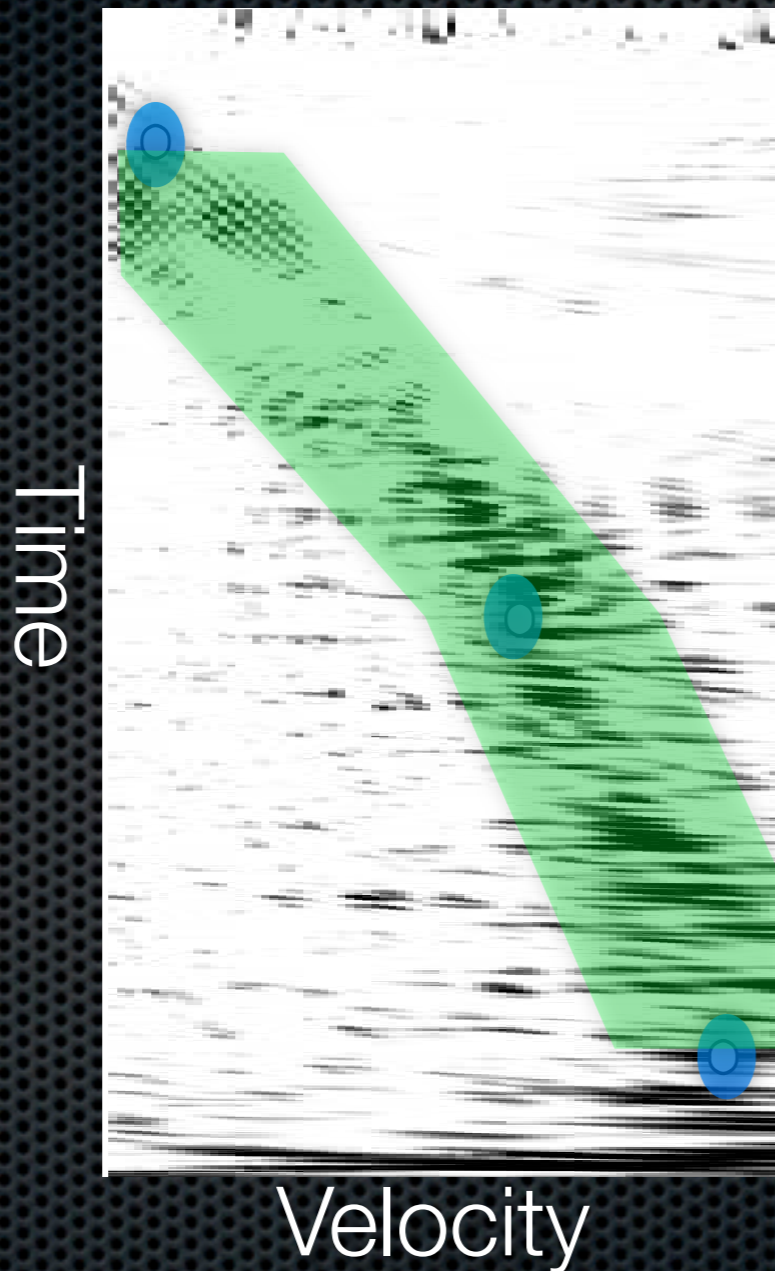
Time



Velocity

Similarity matrix

Motivation
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Hypercube



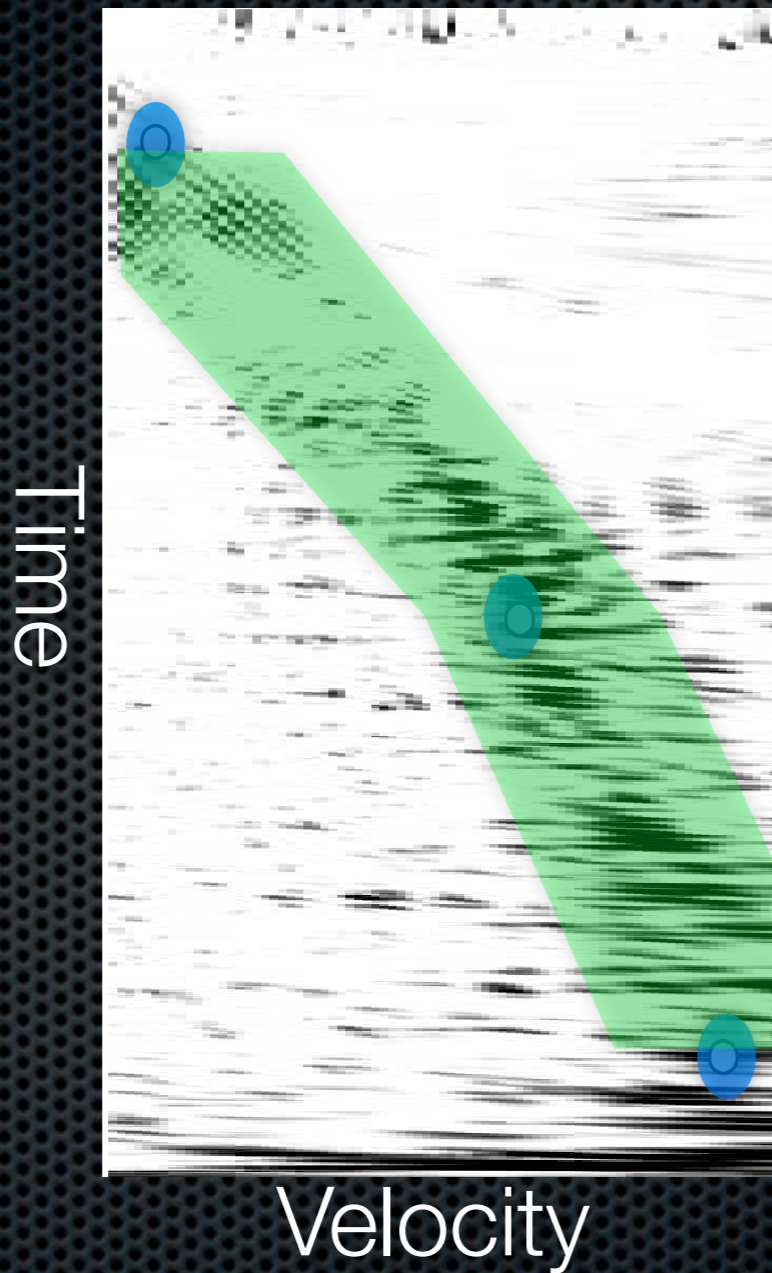
Picked path

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Extensions

Motivation

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Lloyd

Hypercube

- ✦ The concept of a choice is abstract
- ✦ The search space could include epsilon, delta
- ✦ Limiting the search range makes the problem tractable

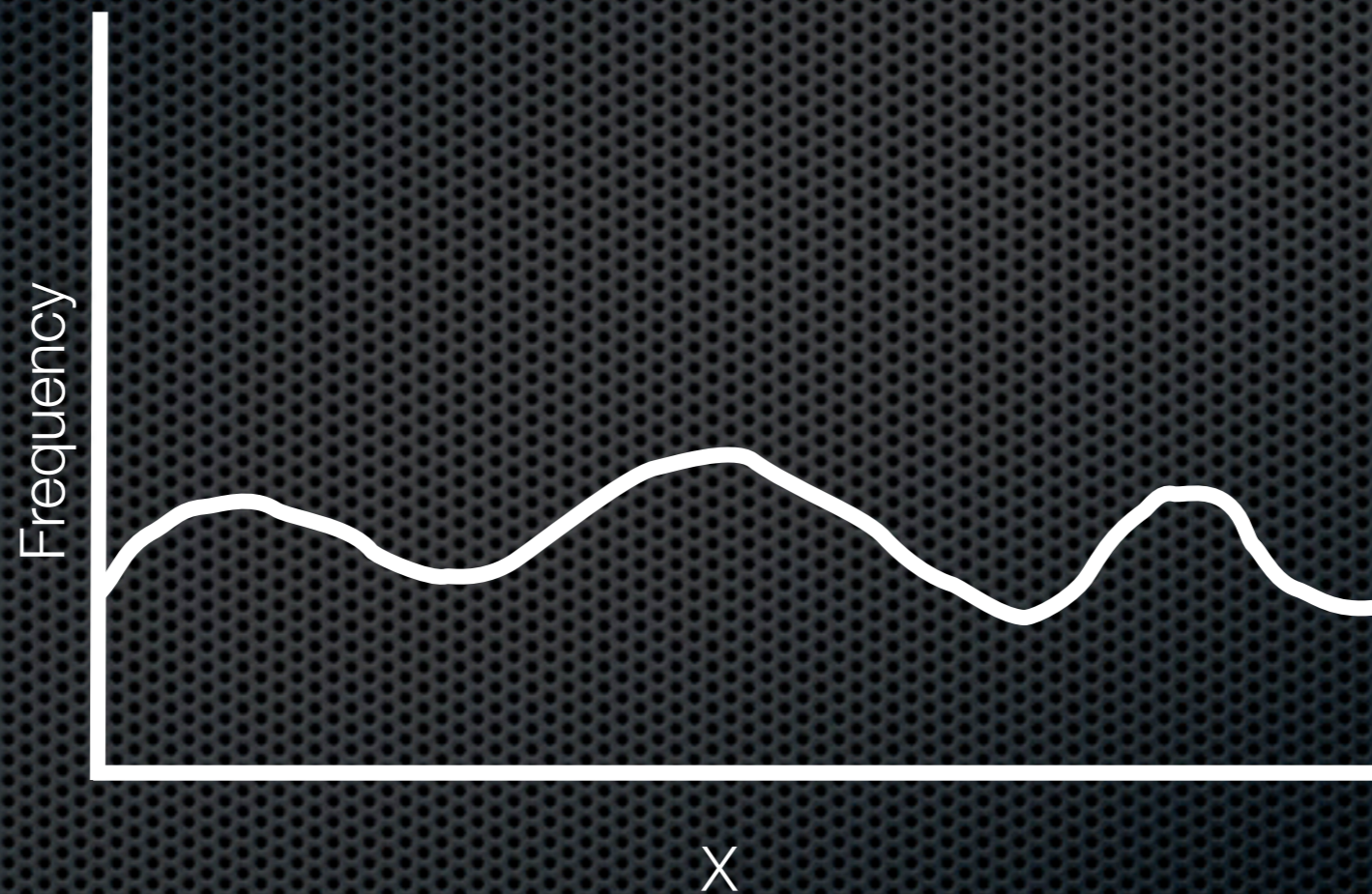
Lloyd's algorithm

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Lloyd

Hypercube



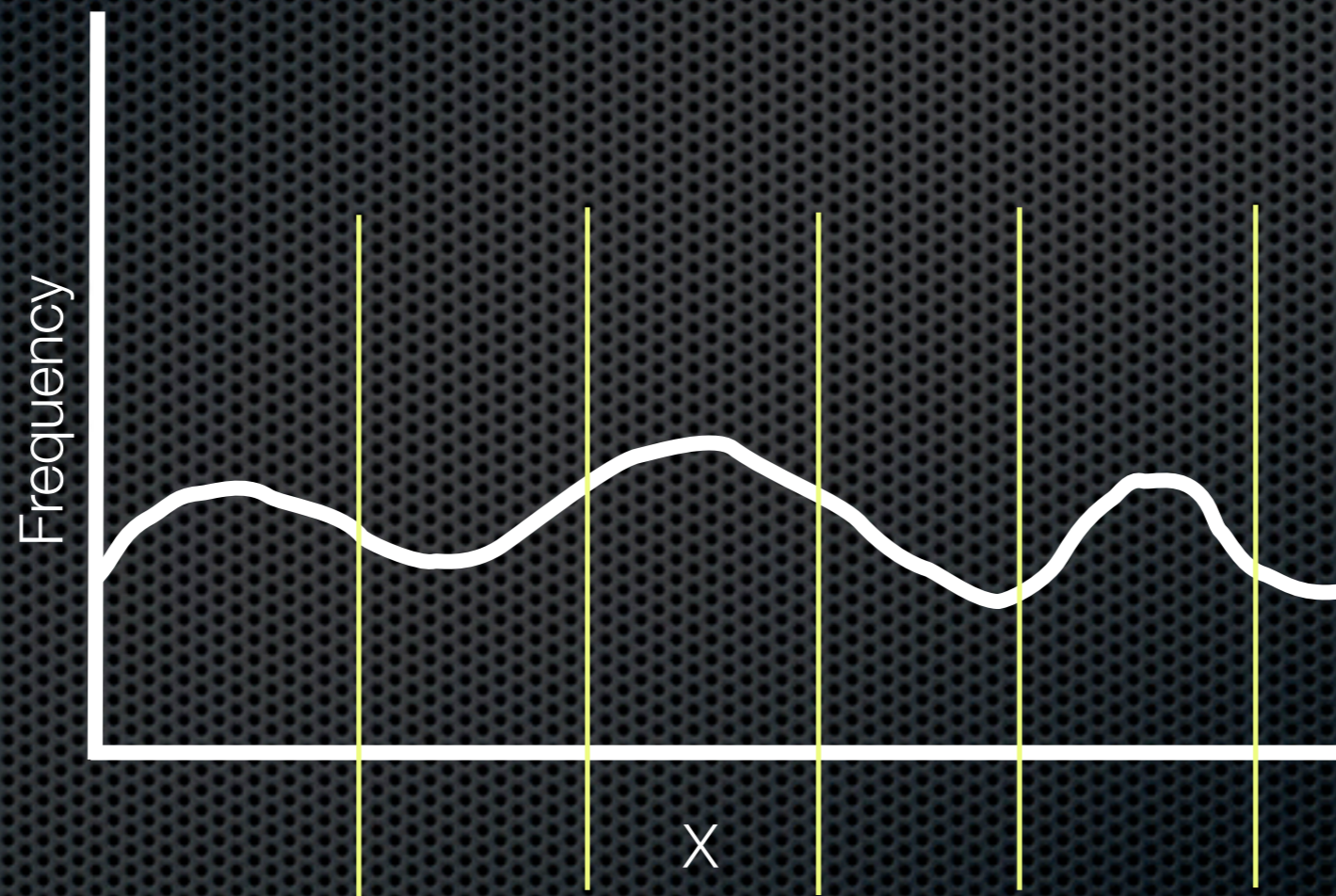
Break into regions

Motivation

Dynamic
Programming

Lloyd

Hypercube



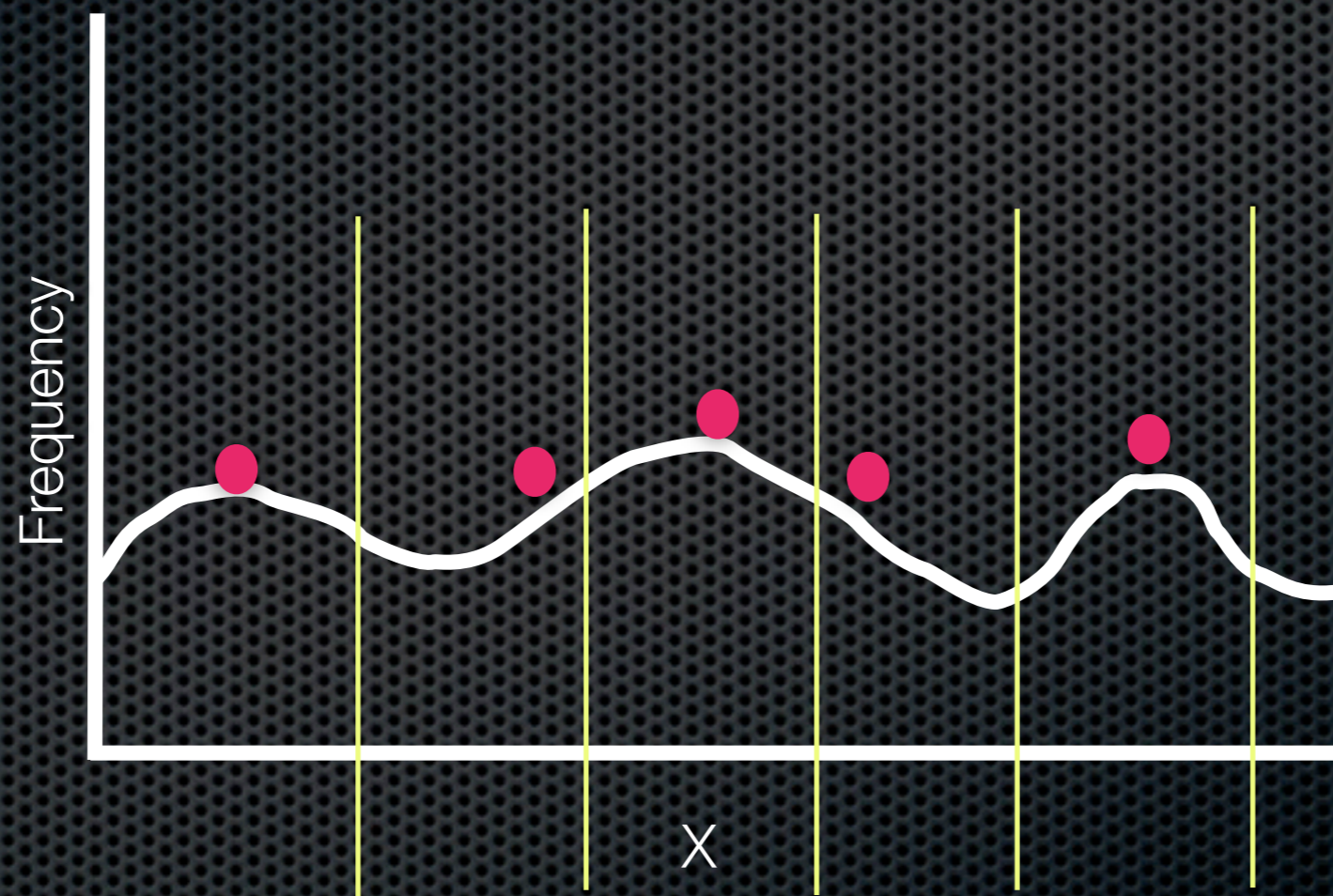
Find the center of mass in region

Motivation

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Lloyd

Hypercube



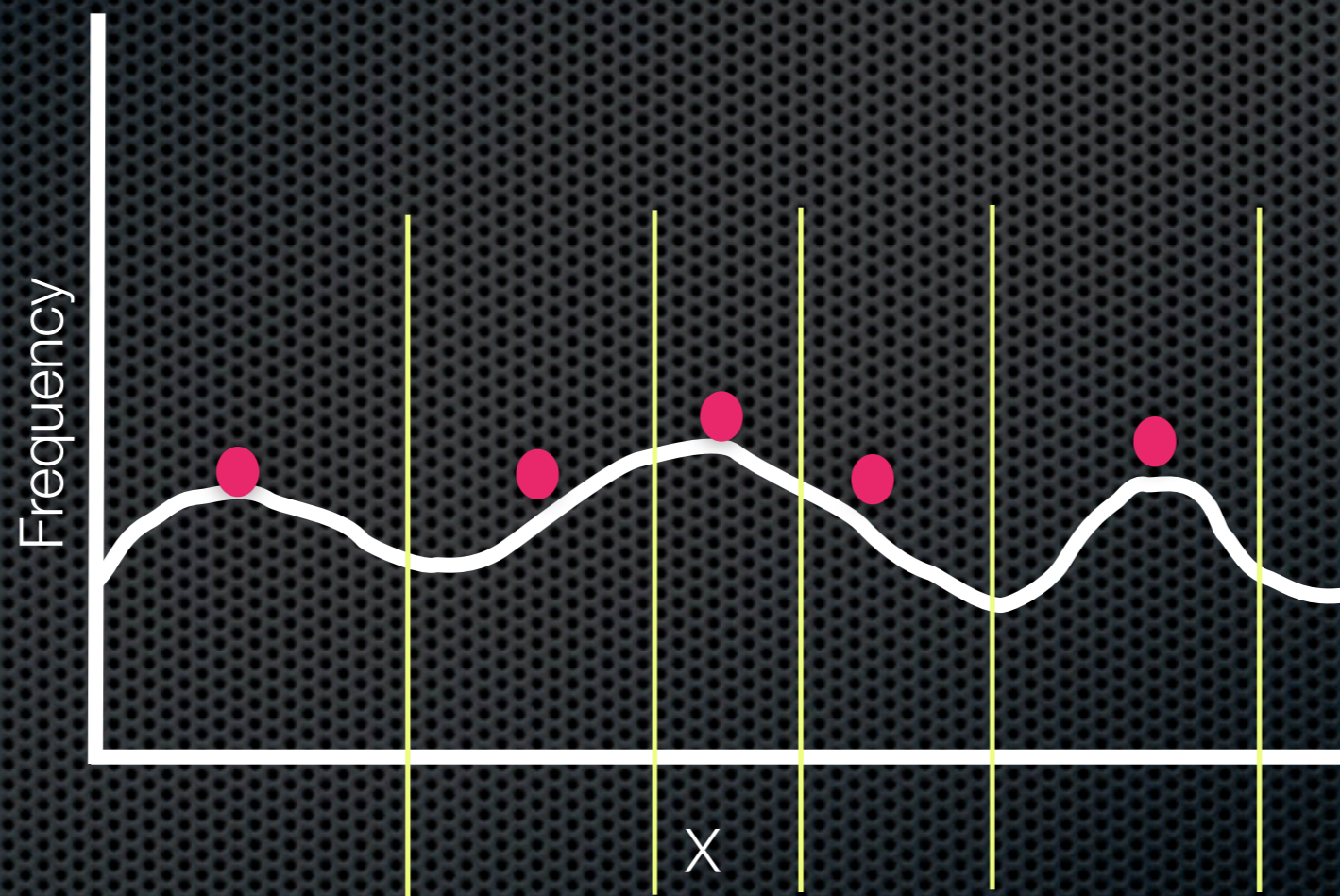
New regions between centers of mass

Motivation

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Programming

Lloyd

Hypercube



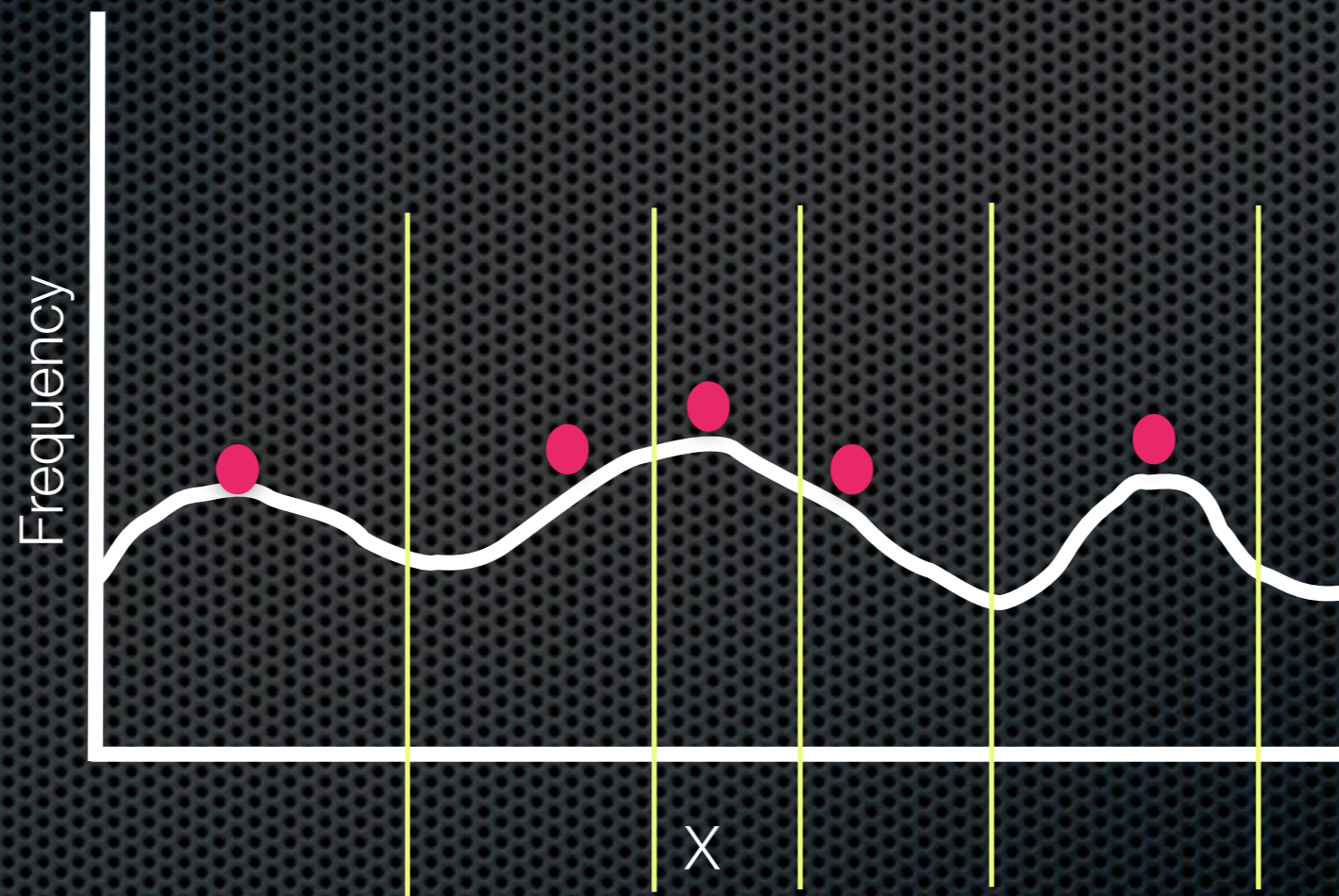
Repeat

Motivation

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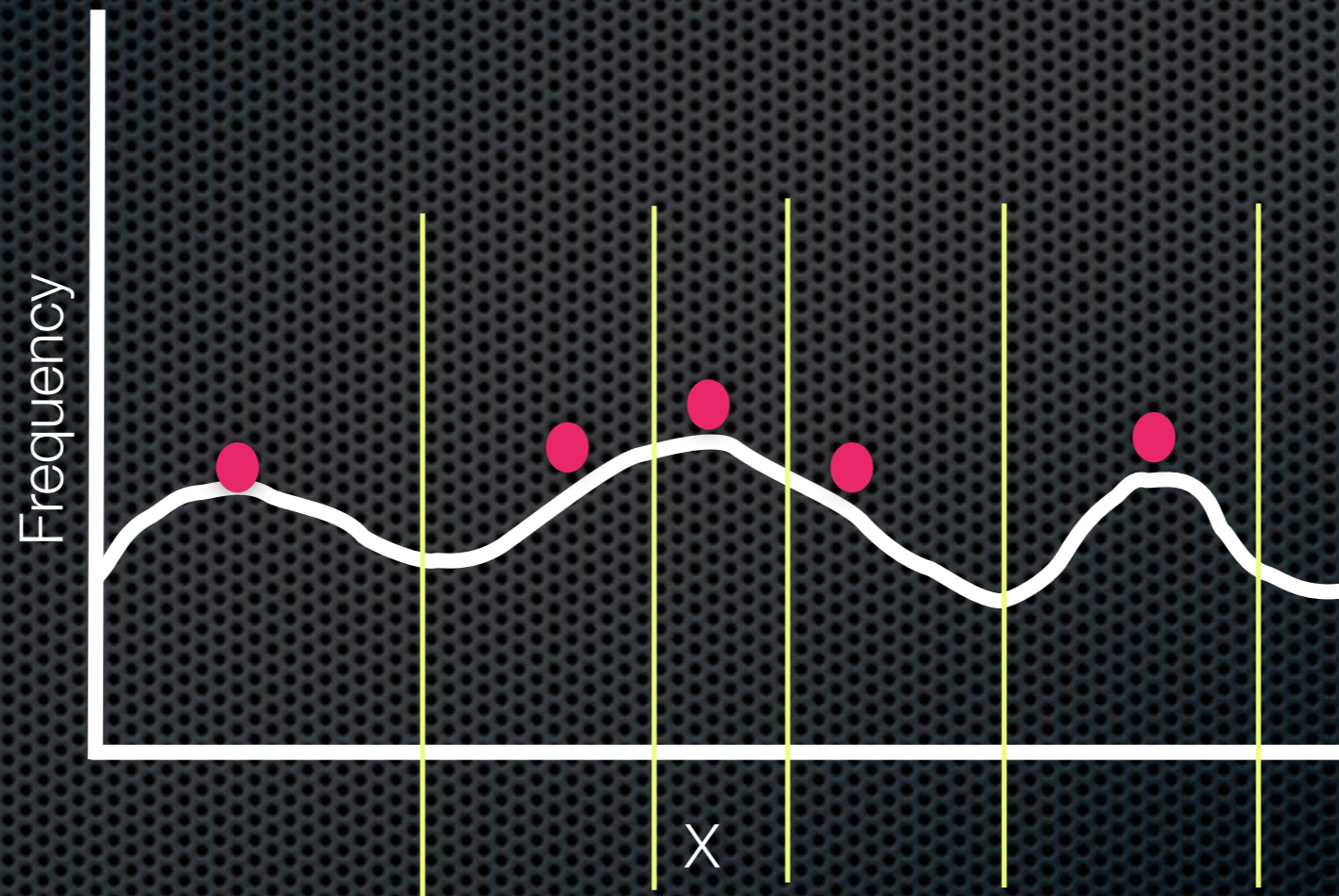
Repeat

Motivation

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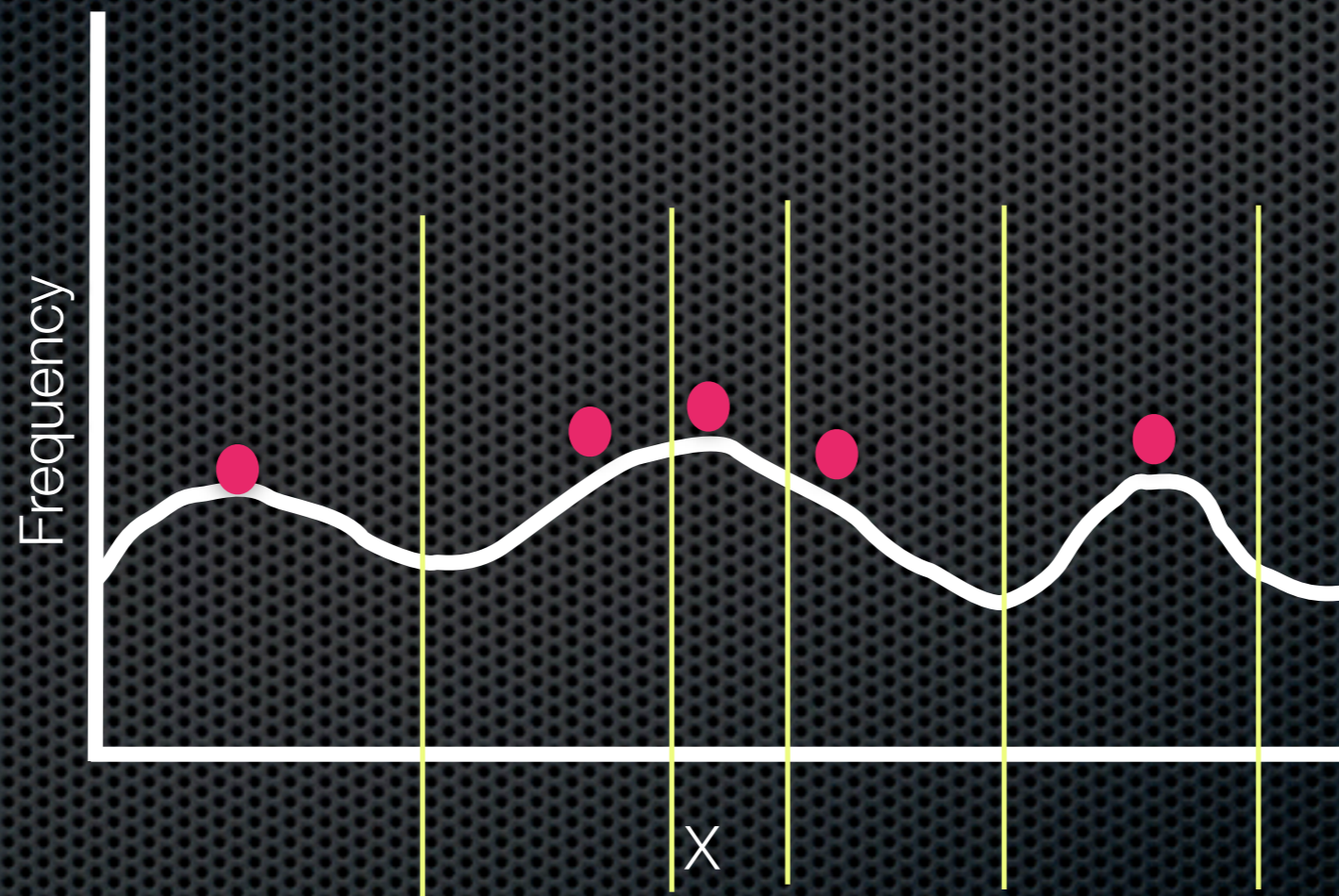
Repeat

Motivation

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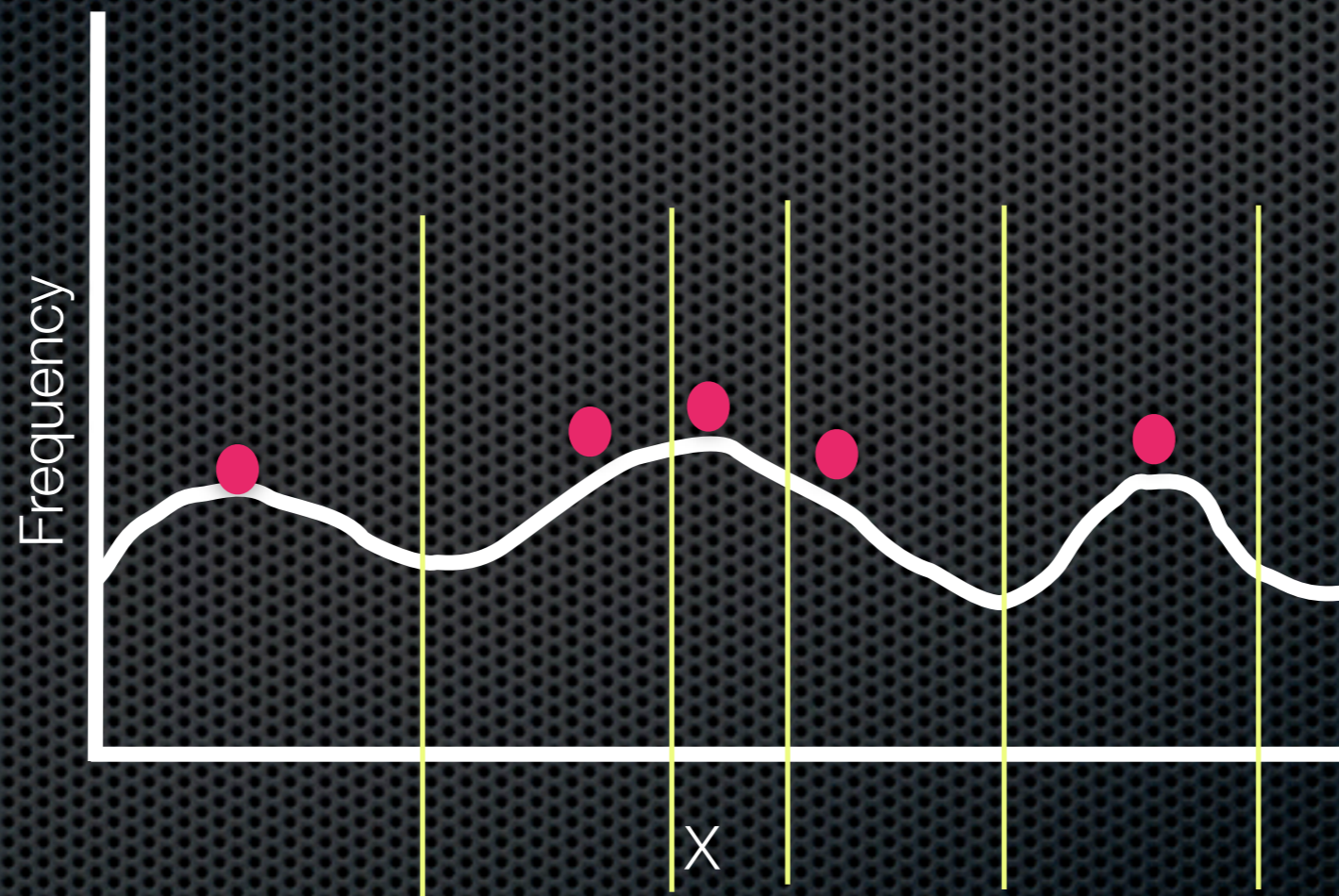
Repeat

Motivation

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Hypercube



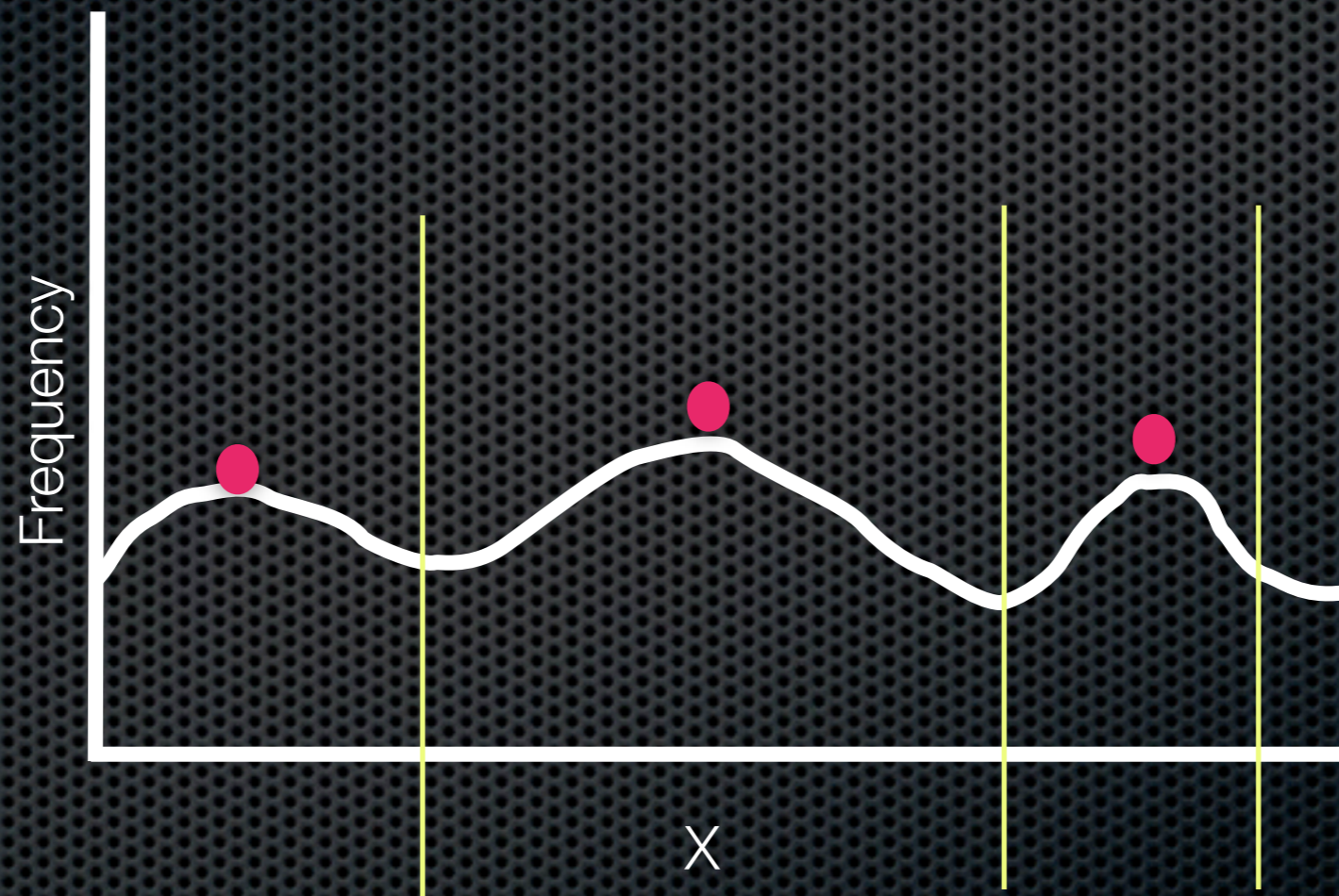
Remove similar regions

Motivation

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Lloyd

Hypercube



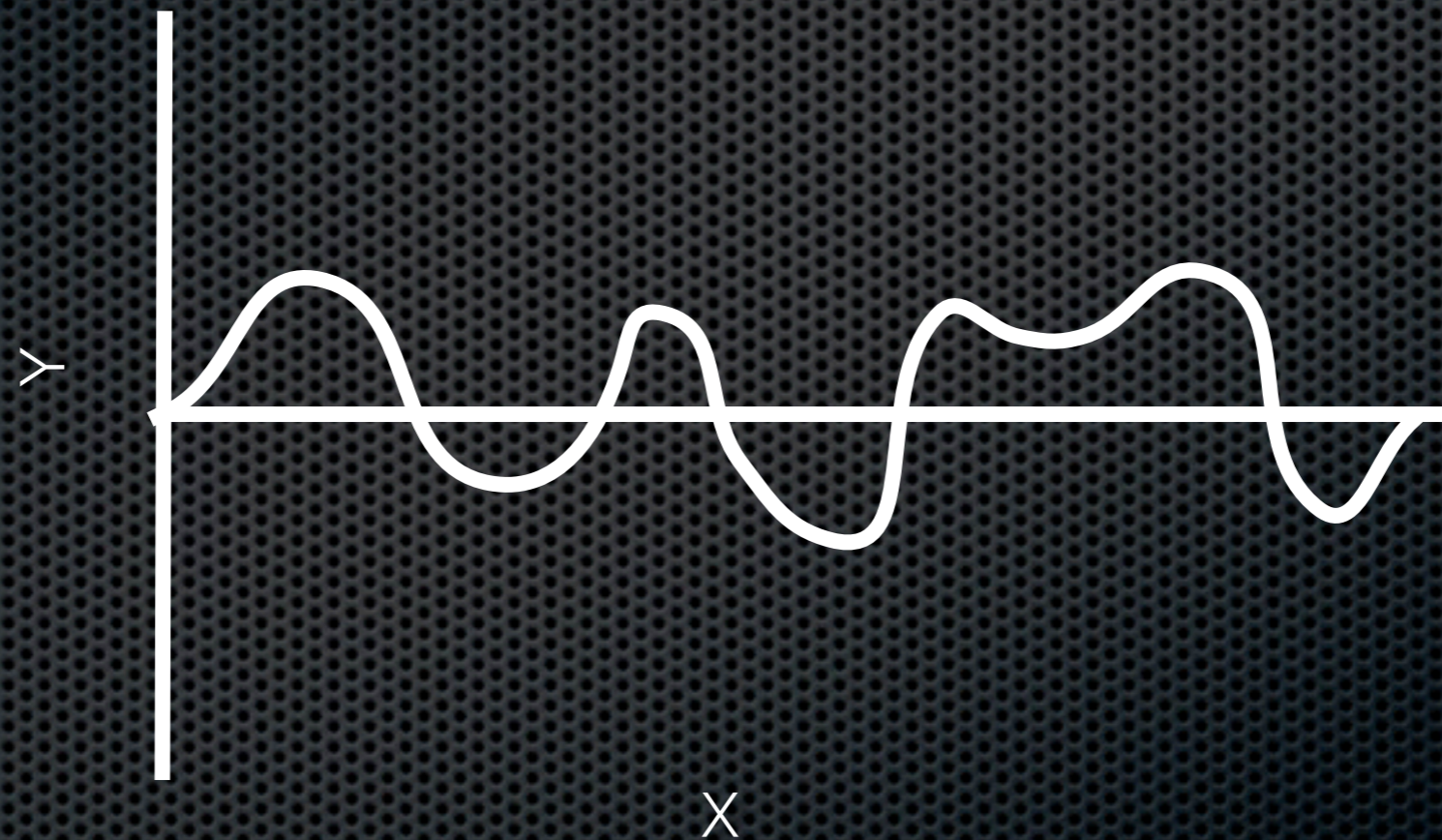
Given a function

Motivation

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Programming

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Hypercube



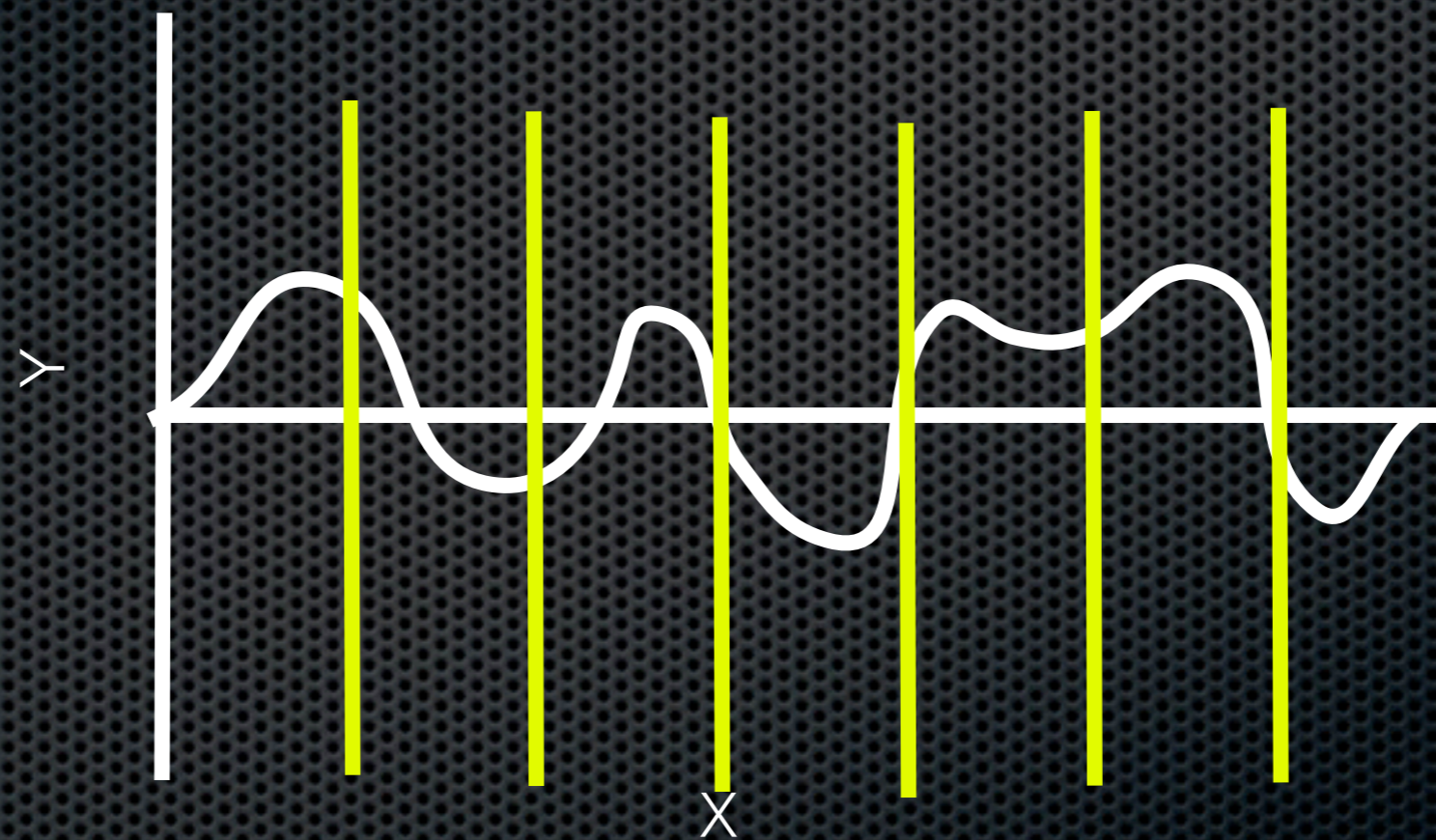
Break into regions

Motivation

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Programming

Lloyd

Hypercube



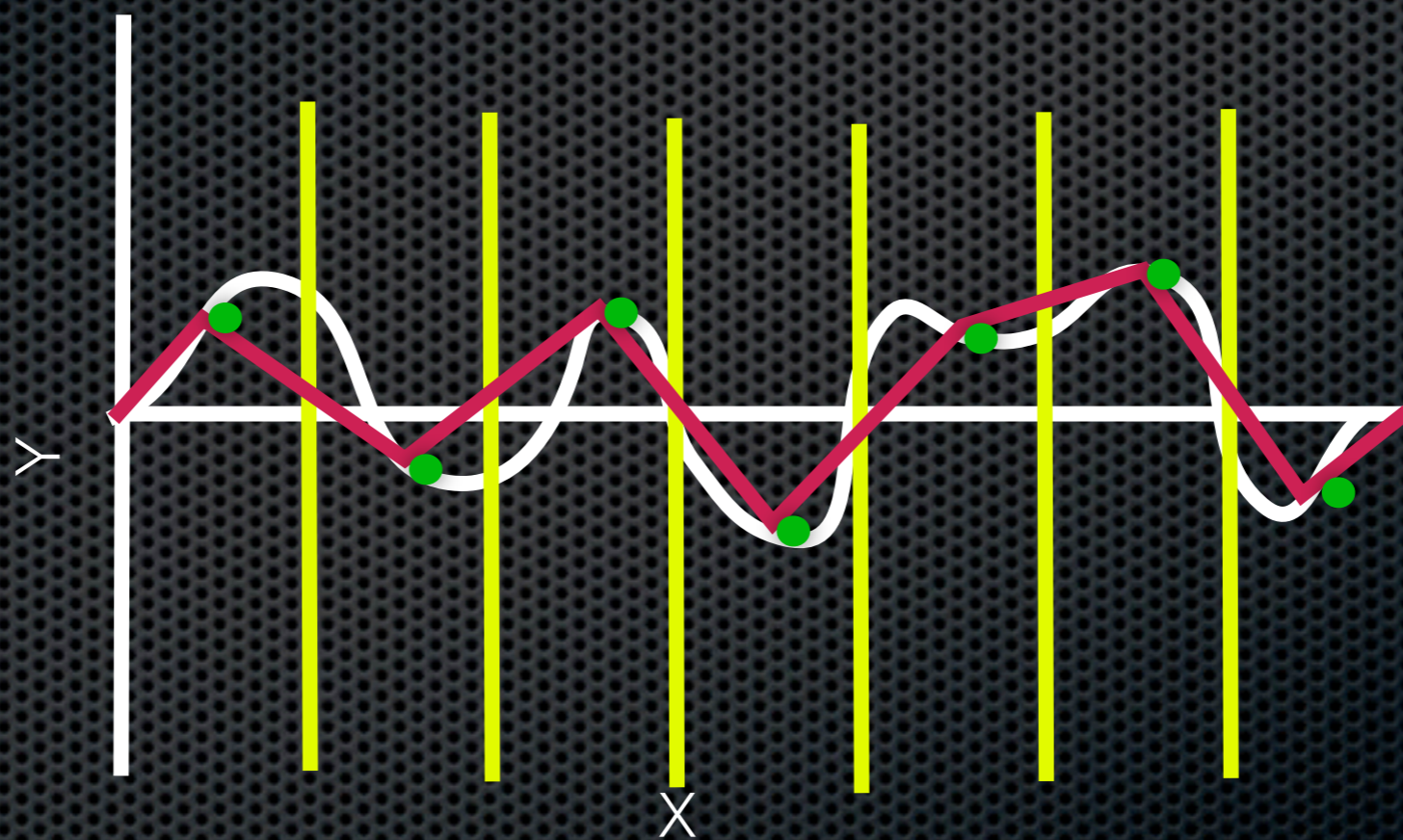
Find background linear function

Motivation

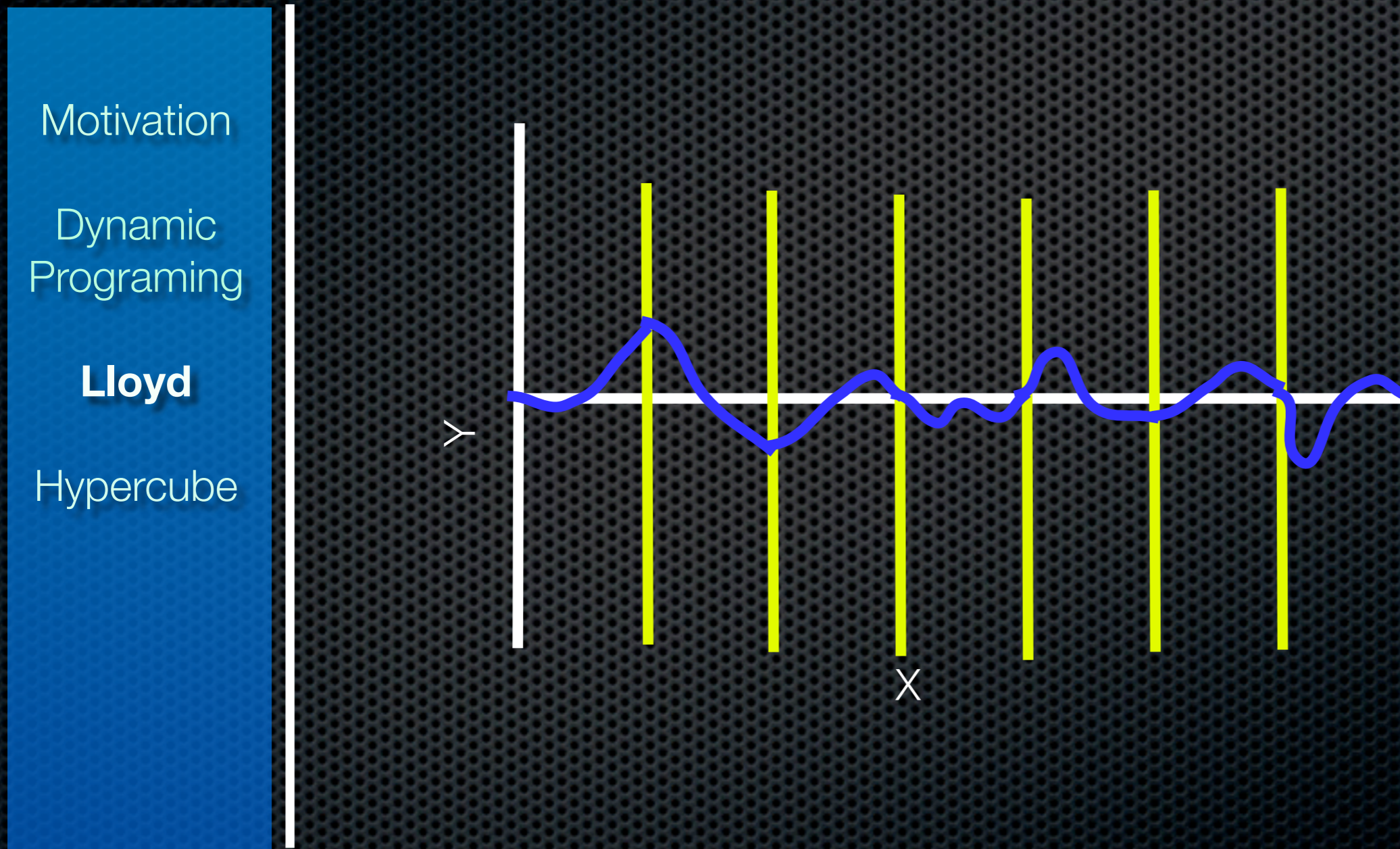
Dynamic
Programming

Lloyd

Hypercube



Residual



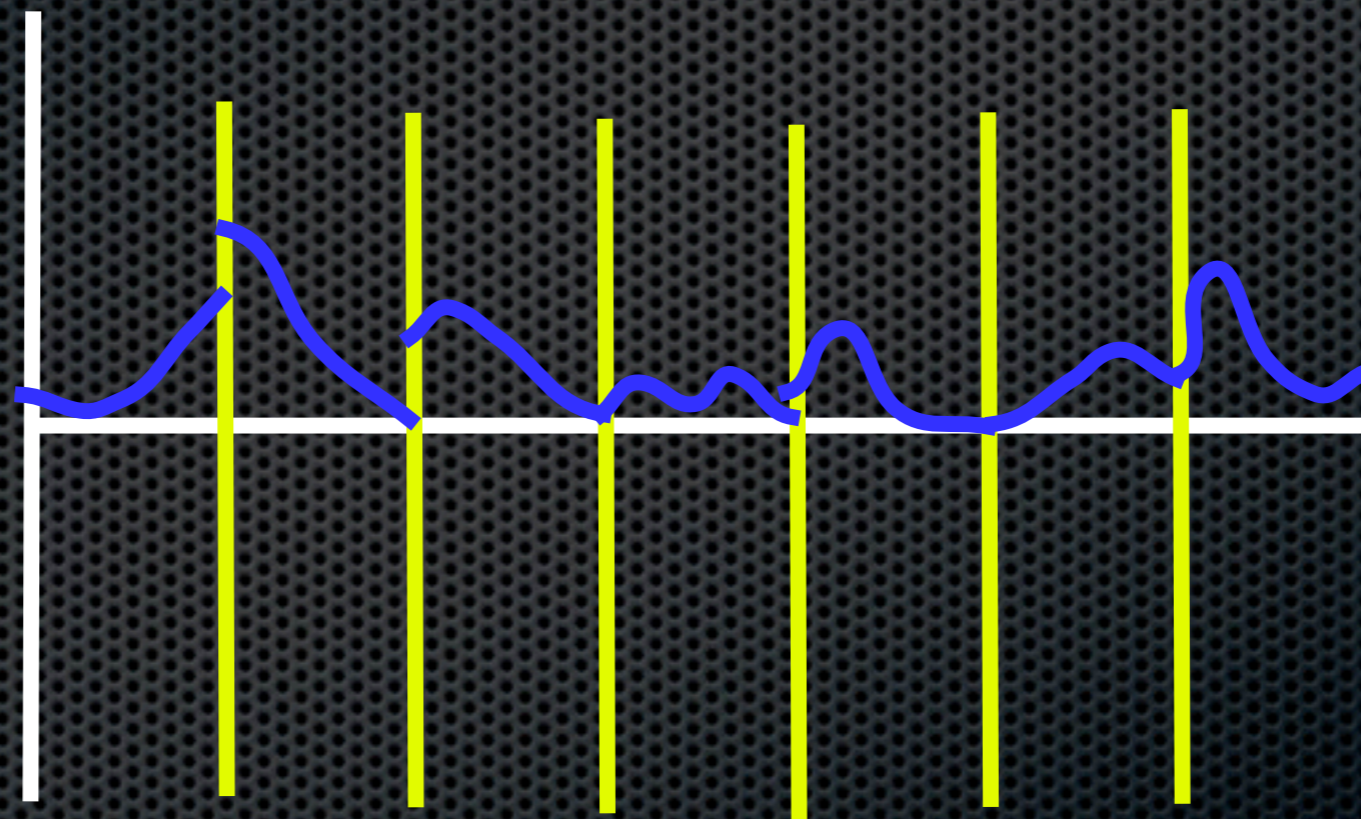
Shift (and flip) for center of mass calculation

Motivation

Dynamic
Programming

Lloyd

Hypercube



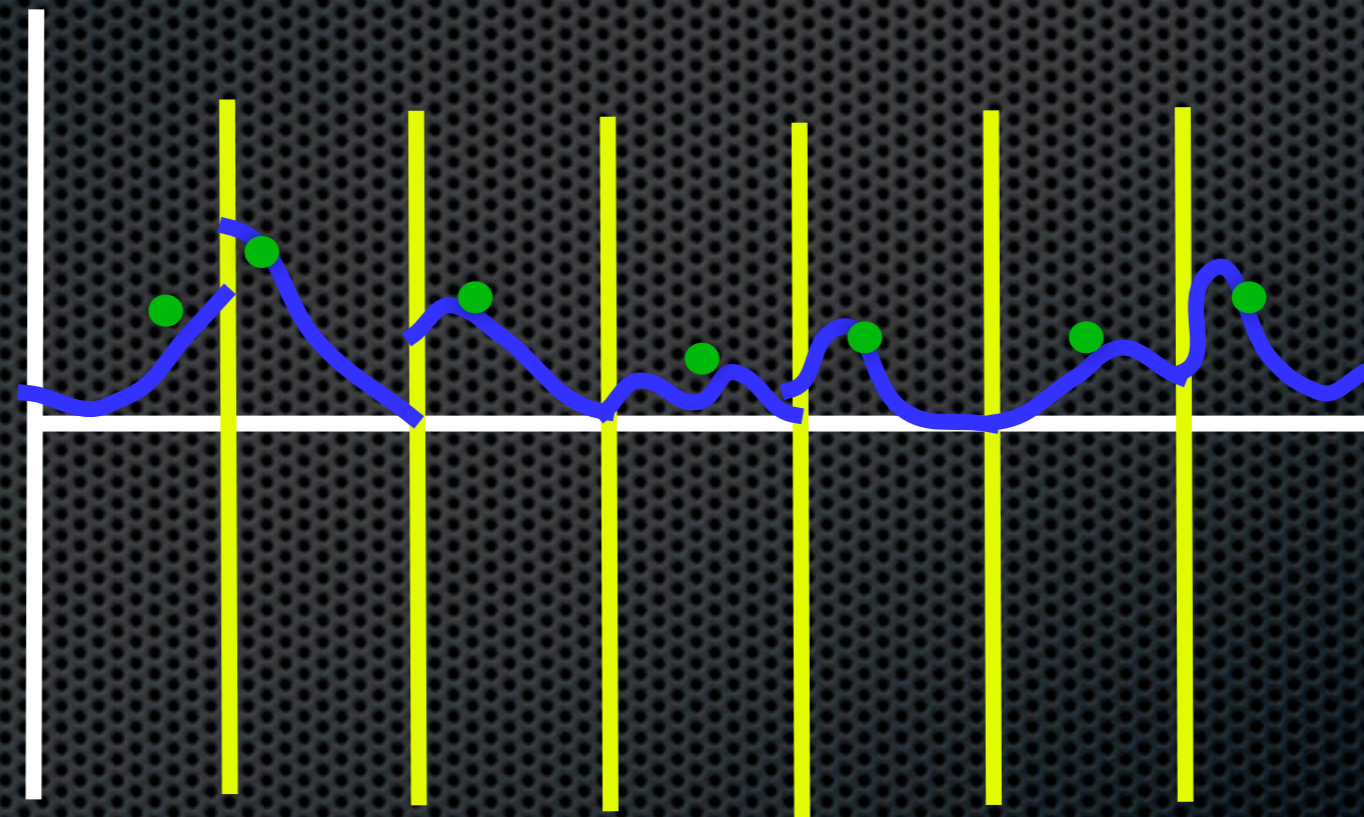
Calculate center of mass

Motivation

Dynamic
Programming

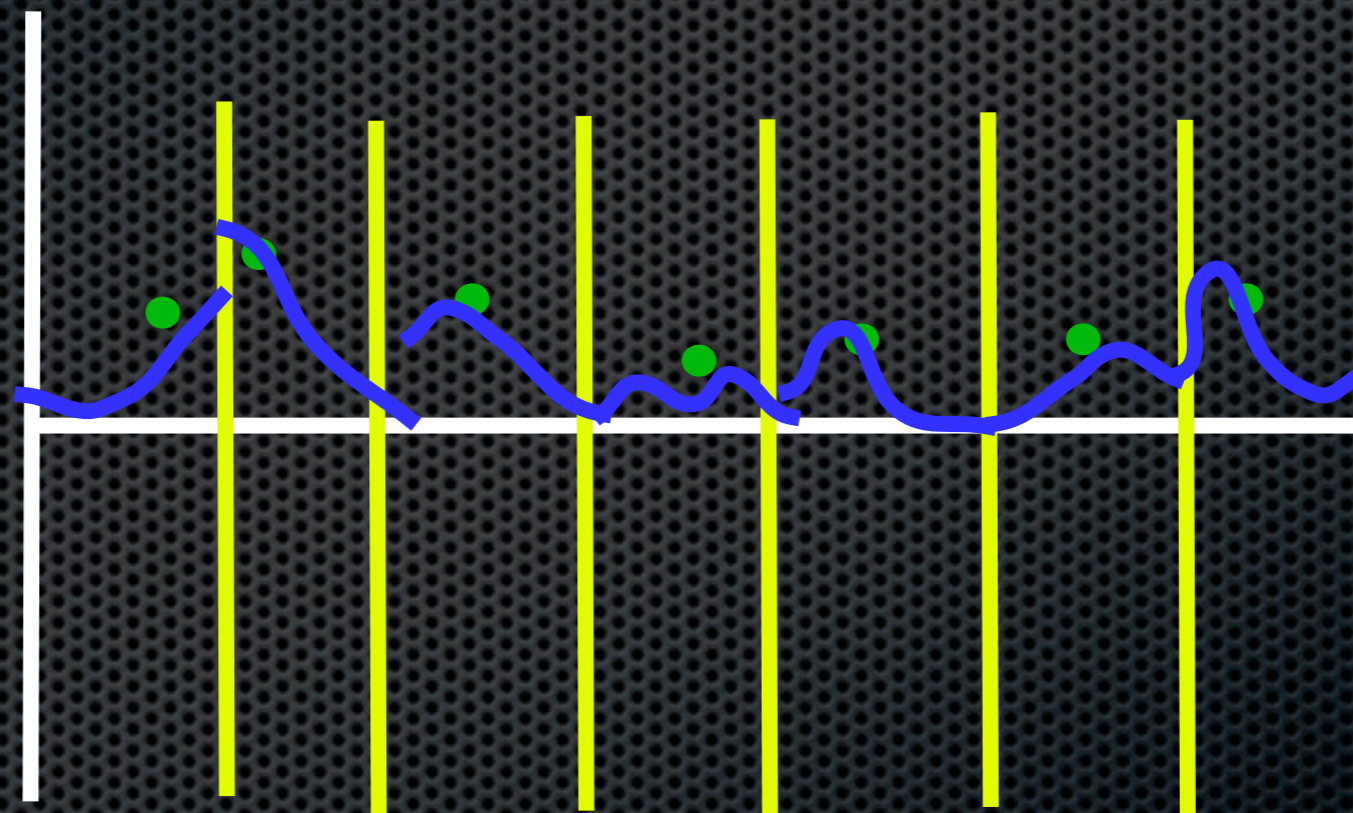
Lloyd

Hypercube



Redo regions

Motivation
Dynamic
Programing
Lloyd
Hypercube



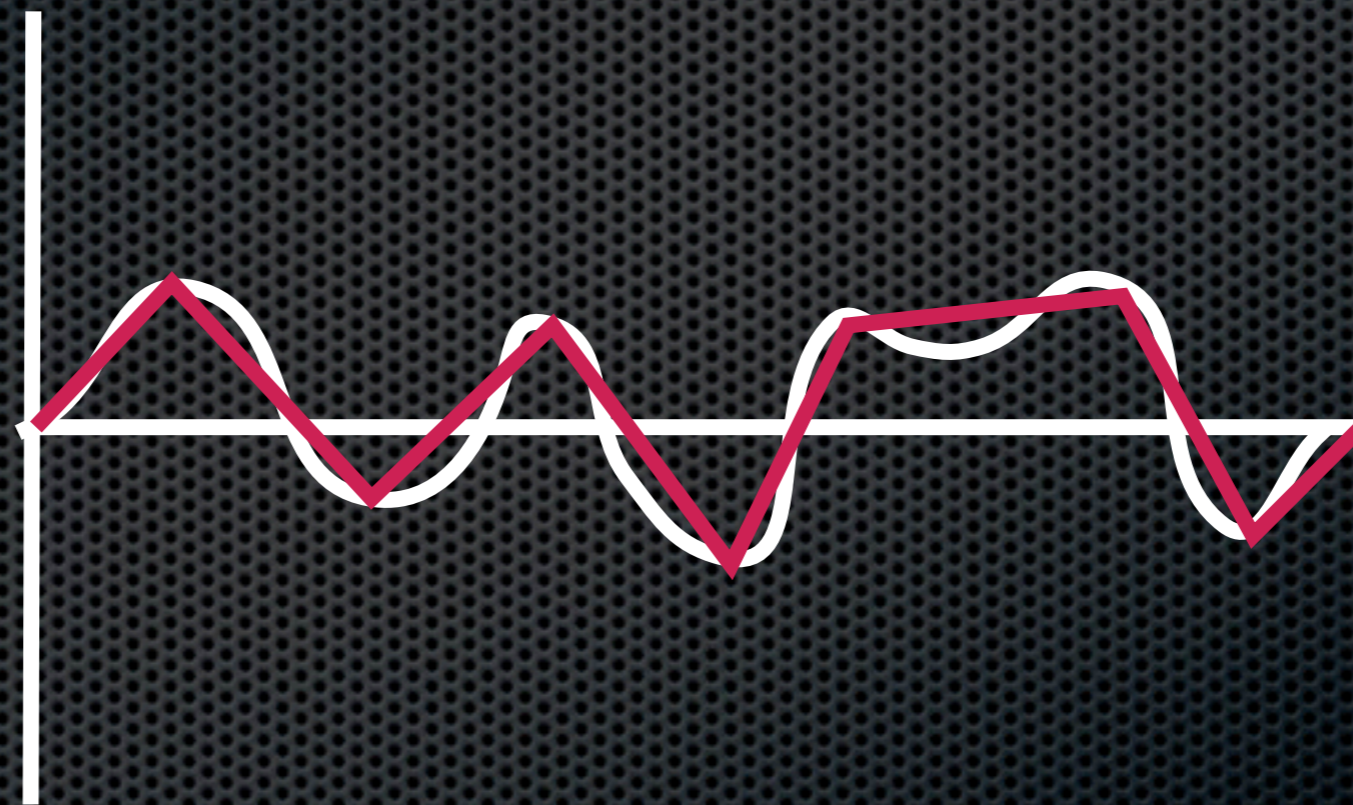
Subsampled line

Motivation

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Programming

Lloyd

Hypercube



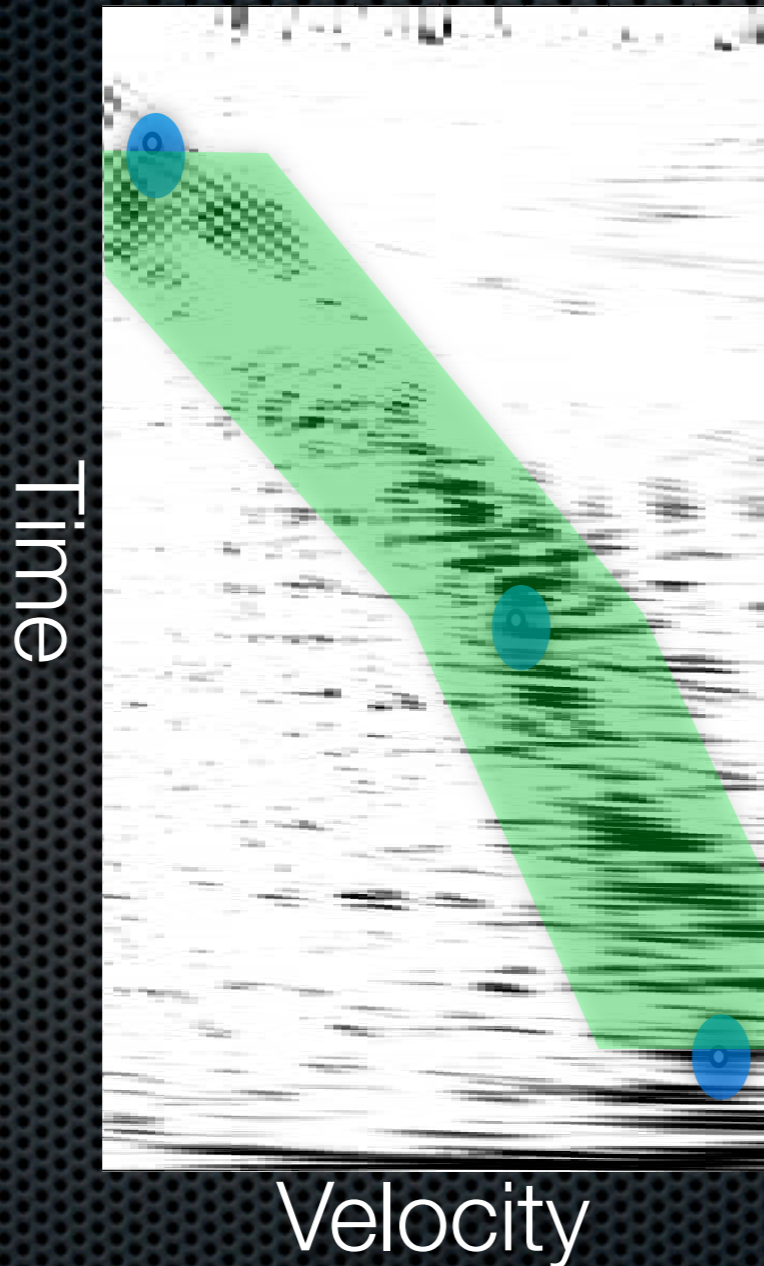
Picked path

Motivation

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Lloyd

Hypercube



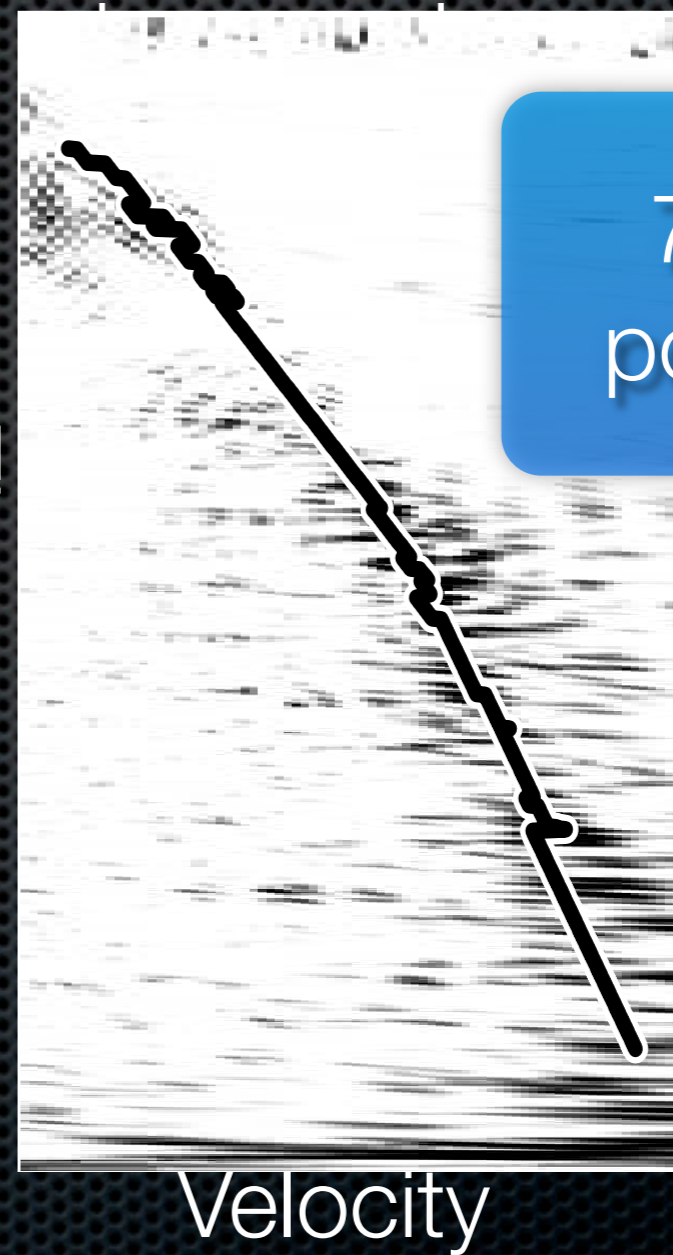
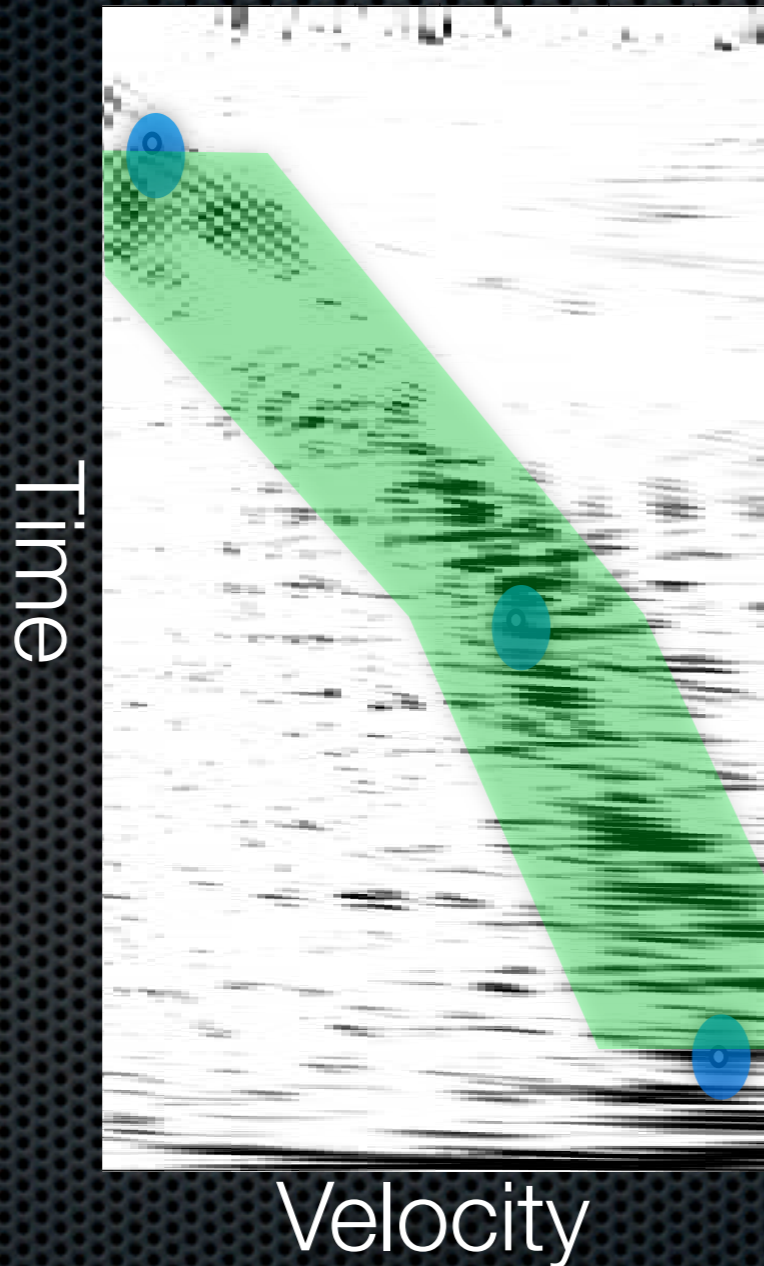
Picked path

Motivation

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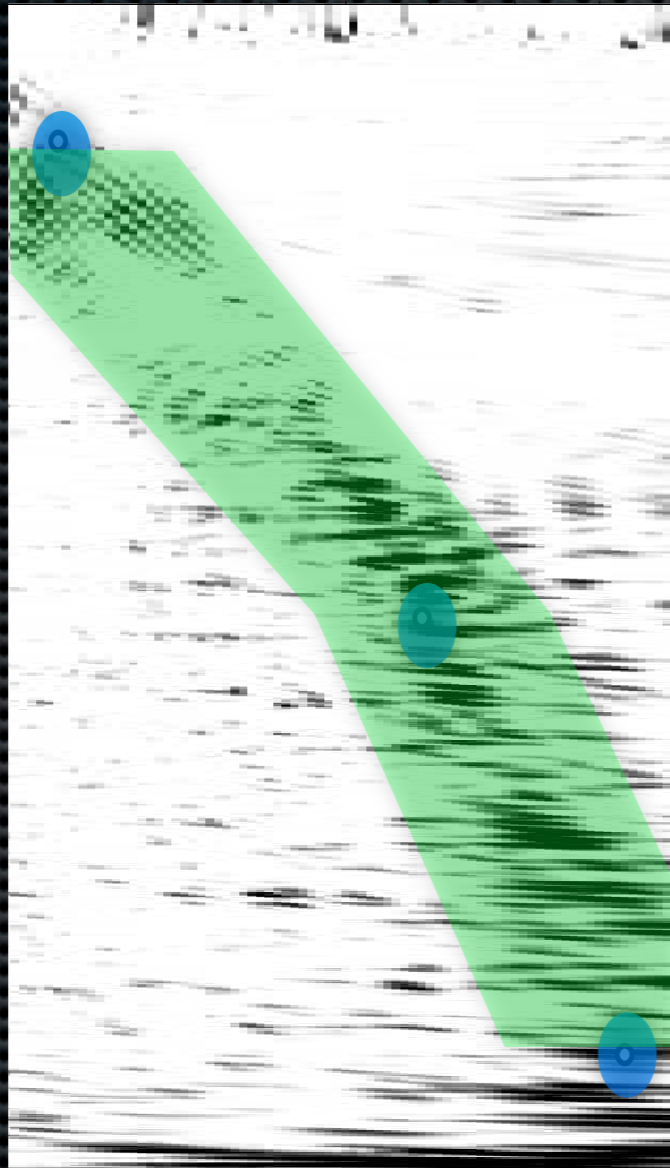
Motivation

Dynamic
Programming

Lloyd

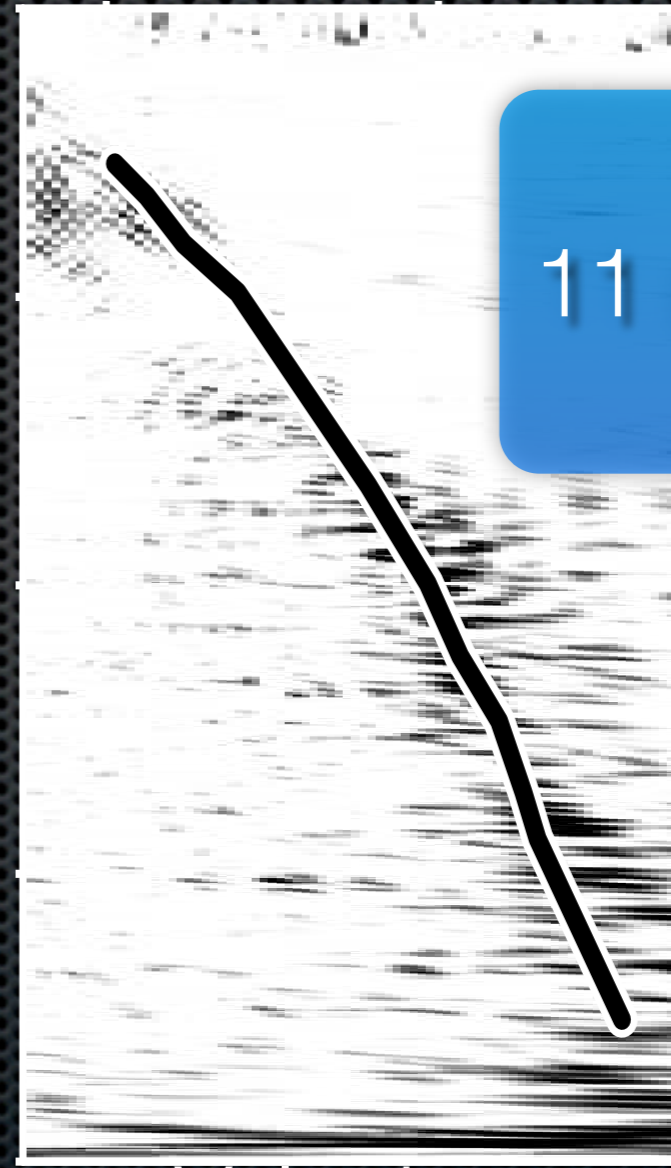
Hypercube

Time



Velocity

Time



11 points

Velocity

Extensions

Motivation

Dynamic
Programming

Lloyd

Hypercube

- ✦ Trivially extendable to N-D
- ✦ Reductions in number of points is multiplicative