

Parallel Programming

PROBLEM

STEPS

Initialization → Matrix Filling → Trace Back

SMITH WATERMAN

NEGATIVE VALUES

BECOMES

0

SMITH WATERMAN

NEGATIVE VALUES

BECOMES

0

Rewards and Penalties

Match

1

Mismatch

-1

Gap

-2

INITIALIZATION

		A	T	G	C	T
A						
G						
C						
T						

Seq 1 **ATGCT**

Seq 1 **AGCT**

INITIALIZATION

		A	T	G	C	T
	0					
A						
G						
C						
T						

Seq 1 **ATGCT**

Seq 1 **AGCT**

INITIALIZATION

		A	T	G	C	T
	0	-2				
A						
G						
C						
T						

Seq 1 **ATGCT**

Seq 1 **AGCT**

INITIALIZATION

		A	T	G	C	T
	0	-2	-4			
A						
G						
C						
T						

Seq 1 **ATGCT**

Seq 1 **AGCT**

INITIALIZATION

		A	T	G	C	T
	0	-2	-4	-6	-8	-10
A						
G						
C						
T						

Seq 1 **ATGCT**

Seq 1 **AGCT**

INITIALIZATION

		A	T	G	C	T
	0	-2	-4	-6	-8	-10
A	-2					
G	-4					
C	-6					
T	-8					

Seq 1 **ATGCT**

Seq 1 **AGCT**

		A	T	G	C	T
	0	-2	-4	-6	-8	-10
A	-2					
G	-4					
C	-6					
T	-8					

Negative



0

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

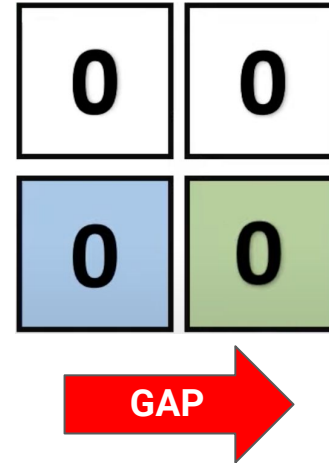
MATRIX FILLING

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

0	0
0	

MATRIX FILLING

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					



MATRIX FILLING

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

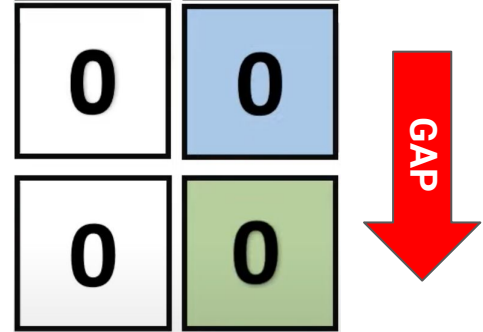
0	0
0	-2

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

0	0
0	

-2

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					



-2

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

0	0
0	-2

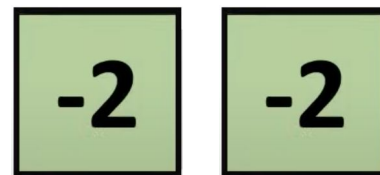
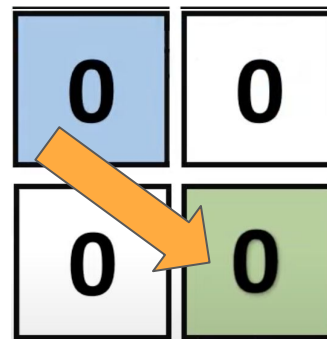
-2

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

0	0
0	

-2	-2
----	----

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					



A = A MATCH

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

0	0
0	0

-2	-2
----	----

A = A MATCH

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

0	0
0	1

-2	-2
----	----

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

Negative



0

-2

-2

1

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

0

0

1

		A	T	G	C	T
	0	0	0	0	0	0
A	0					
G	0					
C	0					
T	0					

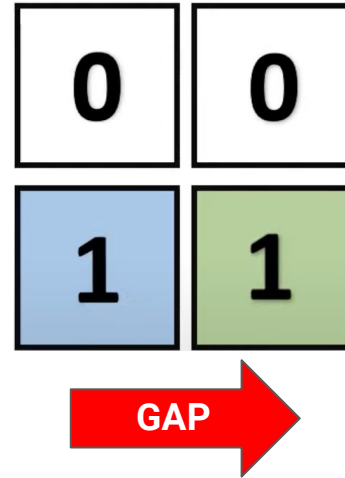
1

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0	0
1	

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

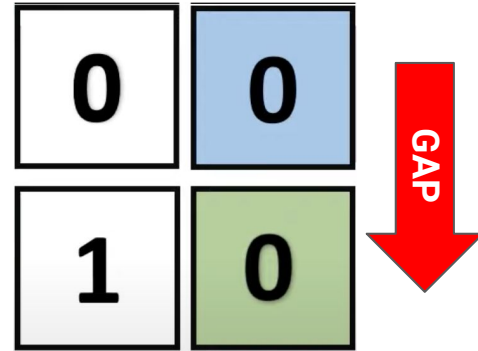


		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0	0
1	

-1

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					



-1

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0	0
1	-2

-1

A ≠ T **MISMATCH**

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0	0
1	0

-1	-2
----	----

A ≠ T MISMATCH

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0	0
1	-1

-1	-2
----	----

A ≠ T **MISMATCH**

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0	0
1	

-1	-2	-1
----	----	----

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0

0

0

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1				
G	0					
C	0					
T	0					

0

0

0

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1	0			
G	0					
C	0					
T	0					

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1	0	0	0	0
G	0	0	0	1	0	0
C	0	0	0	0	2	0
T	0	0	0	0	0	3

TRACE BACK

Start from
Highest Value

Proceed
towards Zeros

An arrow
for a base

Multiple local
alignment
possible

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

4 3 2 1 0

&

2 1 0

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1	0	0	0	0
G	0	0	0	1	0	0
C	0	0	0	0	2	0
T	0	0	0	0	0	3

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1	0	0	0	0
G	0	0	0	1	0	0
C	0	0	0	0	2	0
T	0	0	0	0	0	3

T

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1	0	0	0	0
G	0	0	0	1	0	0
C	0	0	0	0	2	0
T	0	0	0	0	0	3

CT

		A	T	G	C	T
	0	0	0	0	0	0
A	0	1	0	0	0	0
G	0	0	0	1	0	0
C	0	0	0	0	2	0
T	0	0	0	0	0	3

GCT

GCT

Locally Aligned Sequences

Sequence 1	A T G C T
Sequence 2	A G C T



THANKS FOR YOUR ATTENTION!!!

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