Computing the Characteristics of a Subsegment of a Digital Straight Line in Logarithmic Time

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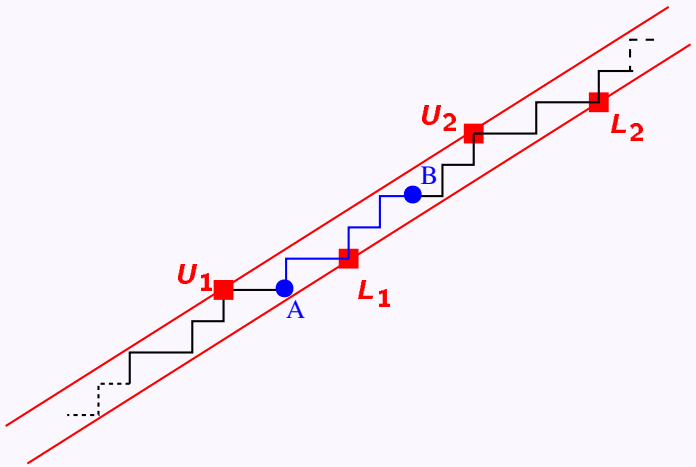
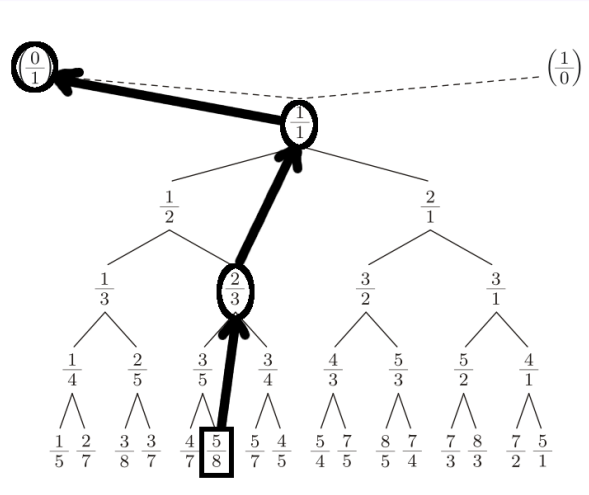
Introduction

- Compute the exact (minimal) characteristics of a DSS.
- Move in a bottom-up way along the Stern-Brocot Tree.
- Prove the correctness of this algorithm.
- Compare this algorithm with the SmartDSS algorithm and the classical DSS recognition algorithm.
- Compute the multiresolution of a digital object.



DSL D(5,8,0) and DSS AB(2,3,1)

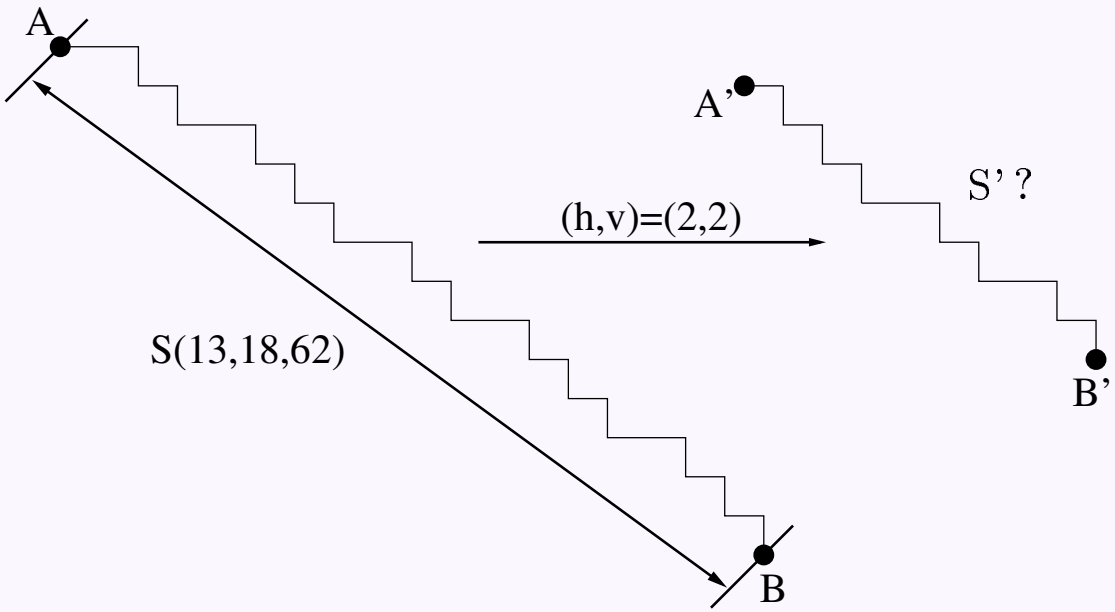


Stern-Brocot Tree

ReversedSmartDSS algorithm to recognize segments

- we know that $S' \subset D'$, D' with known characteristics
- calculate L_1, $L2$, U_1 and U_2 (L_m ?)
- test LeftLowerSlope, RightLowerSlope and UpperSlope.

characteristics of S', $\subset D'(13, 18, 16)$?



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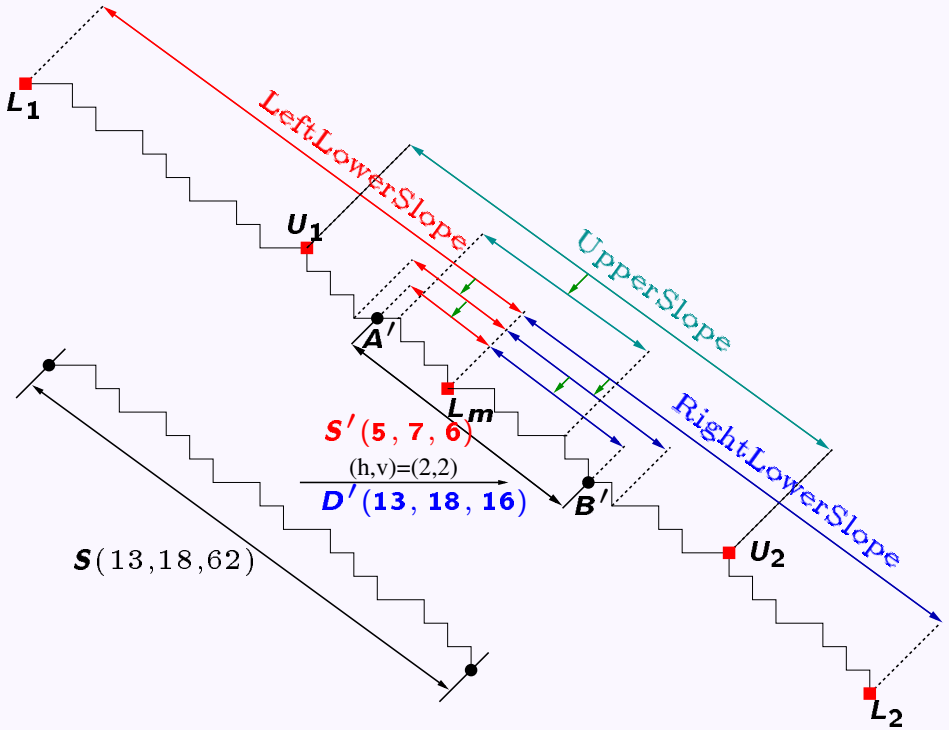
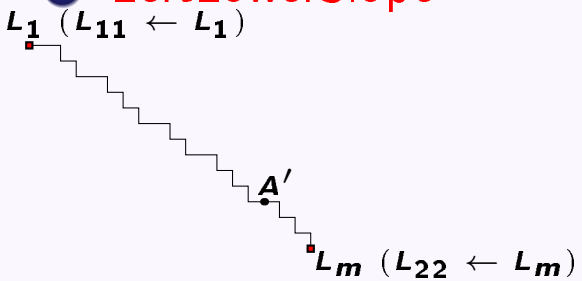


Reversed SmartDSS Algorithm

1. LeftLowerSlope



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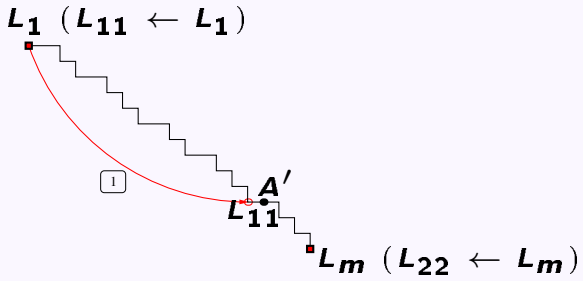

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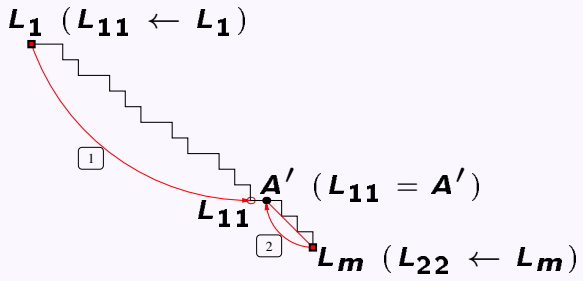

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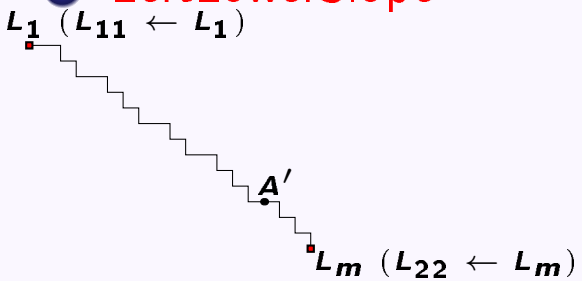

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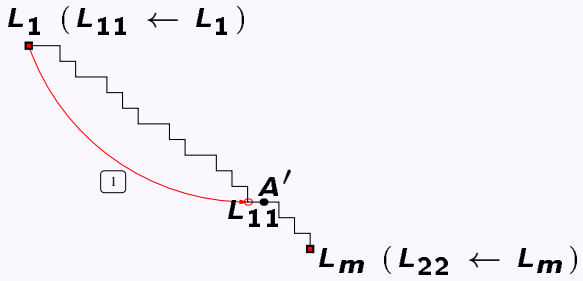

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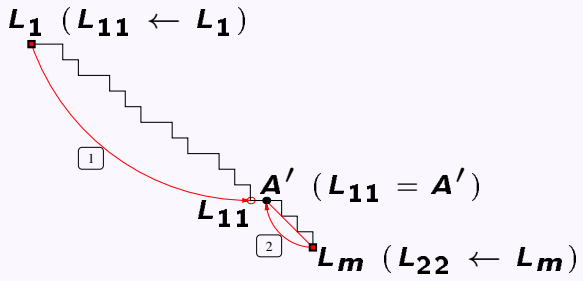

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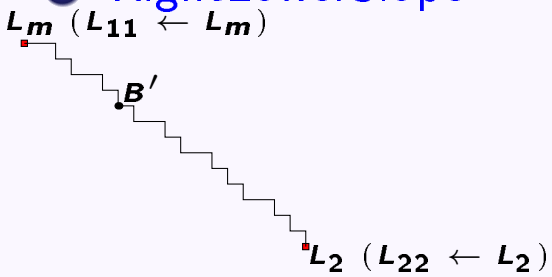
2. RightLowerSlope



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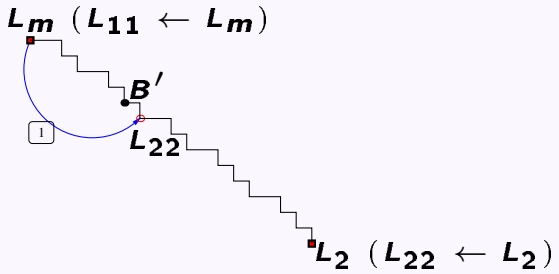

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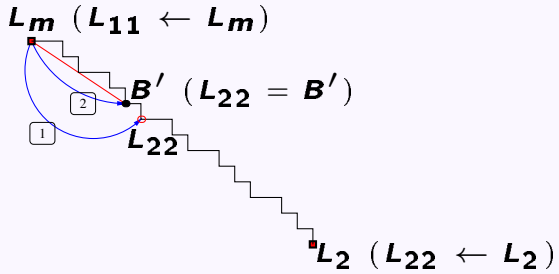

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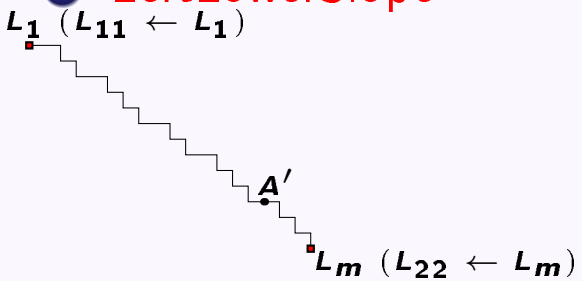

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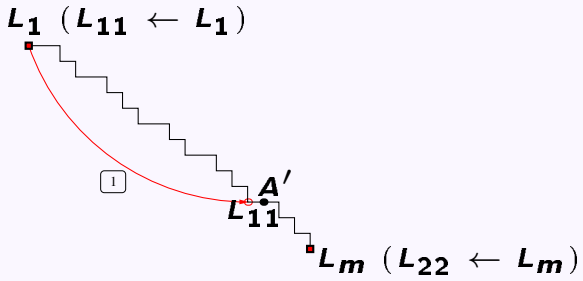

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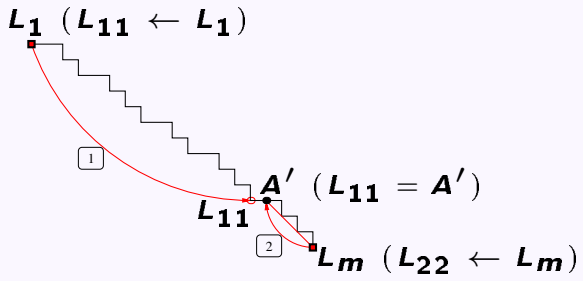

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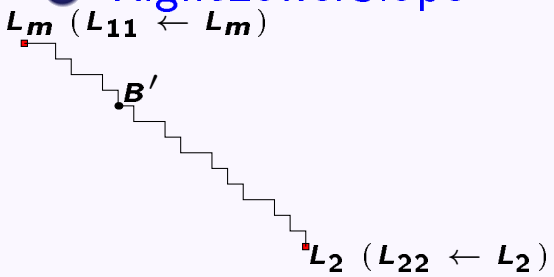

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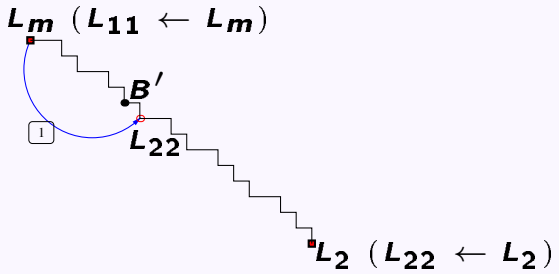

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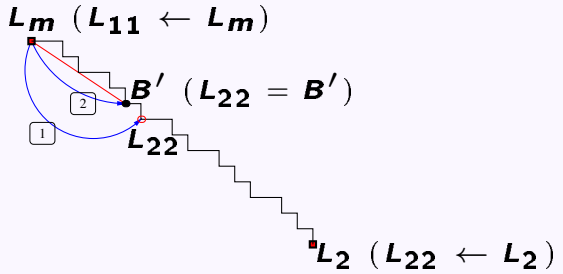

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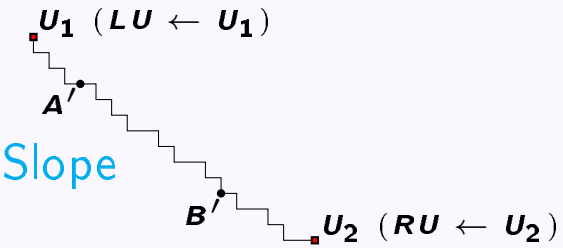
3. UpperSlope



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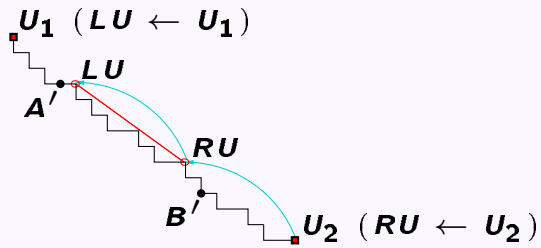

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Timing measures

Shape	Flower			Circle			Polygon		
# points	67494			16004			15356		
# segments	1991			574			44		
h, v	2	4	10	2	4	10	2	4	10
# points (h, v)	33744	16870	6750	8000	4000	1600	7676	3840	1532
MultiScale Smart DSS									
# points tested	19352	11254	4367	5413	2977	1019	782	667	527
timings (ms)	3.1286	2.6446	2.2914	0.997	0.8902	0.7618	0.1258	0.1142	0.0946
MultiScale Reversed Smart DSS									
timings (ms)	2.361	2.113	1.813	0.757	0.712	0.513	0.106	0.0912	0.084

Conclusion

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- Present a novel fast DSS recognition algorithm.
- computational complexity is $\Theta(k - k')$.
- Compute the exact multiscale covering of a digital contour in a time proportional to $M \times T$.
- In most cases, this is clearly sublinear, and at worst, linear in the size of the contour.