Learning Graph Matching Substitution Weights based on a Linear Regression

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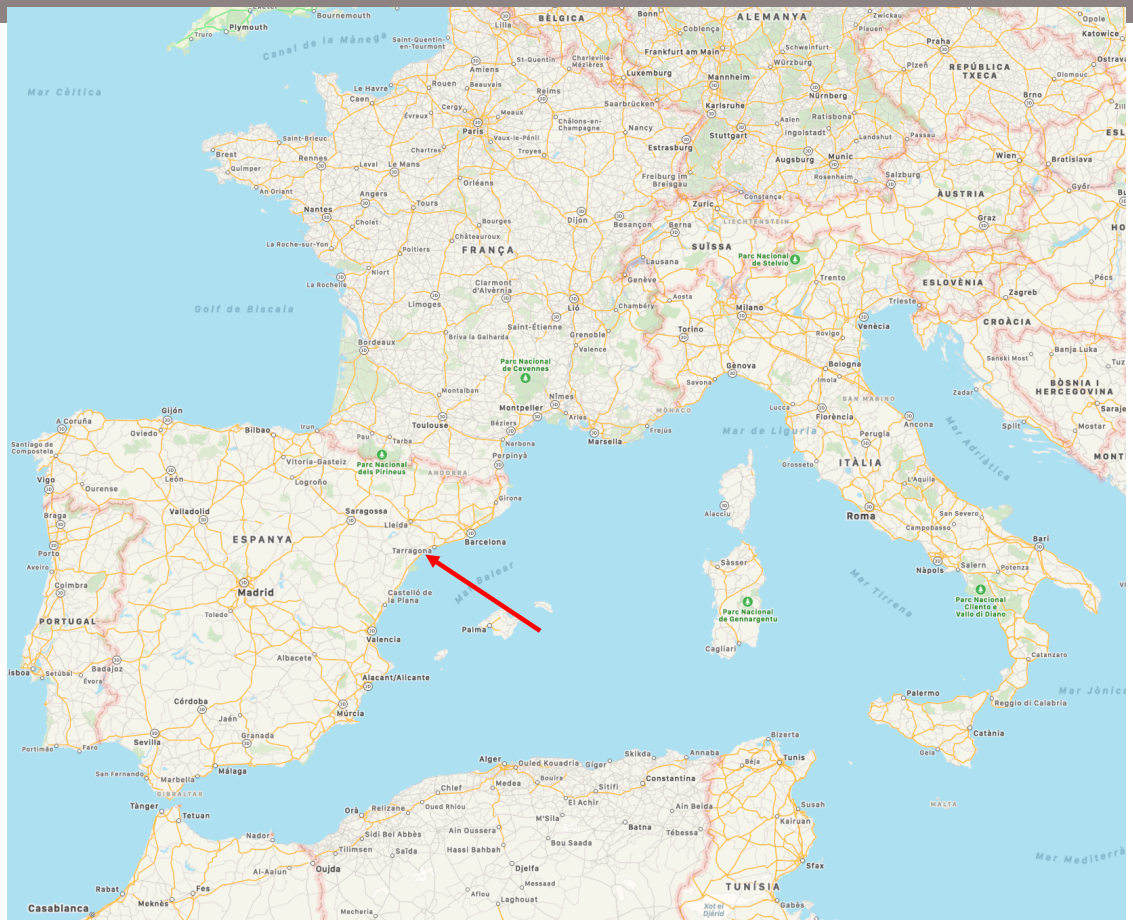

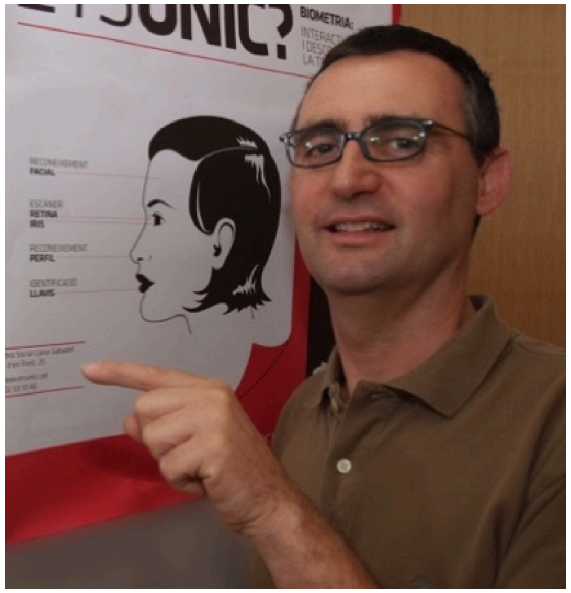

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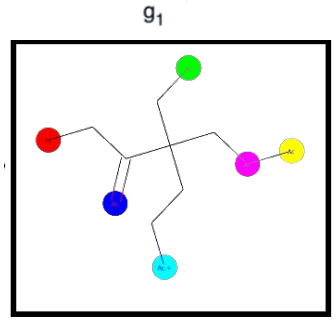
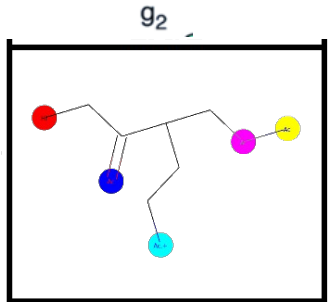
Introduction

Attributed graphs are structures that are useful to represent objects through the information of their local parts and their relations.

We present a method to **learn the weights** on nodes and edges.

These weights gauge the **importance** of each attribute while computing the distance between graphs.





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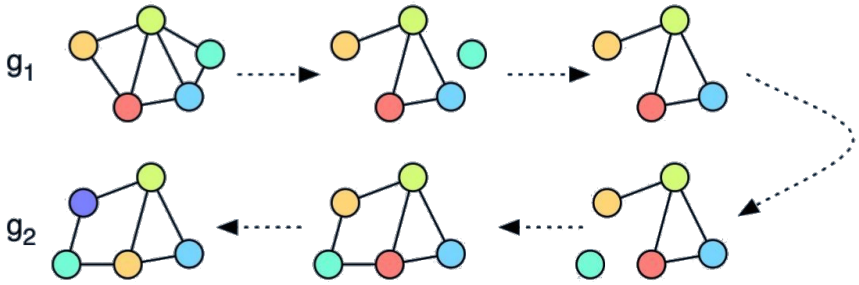
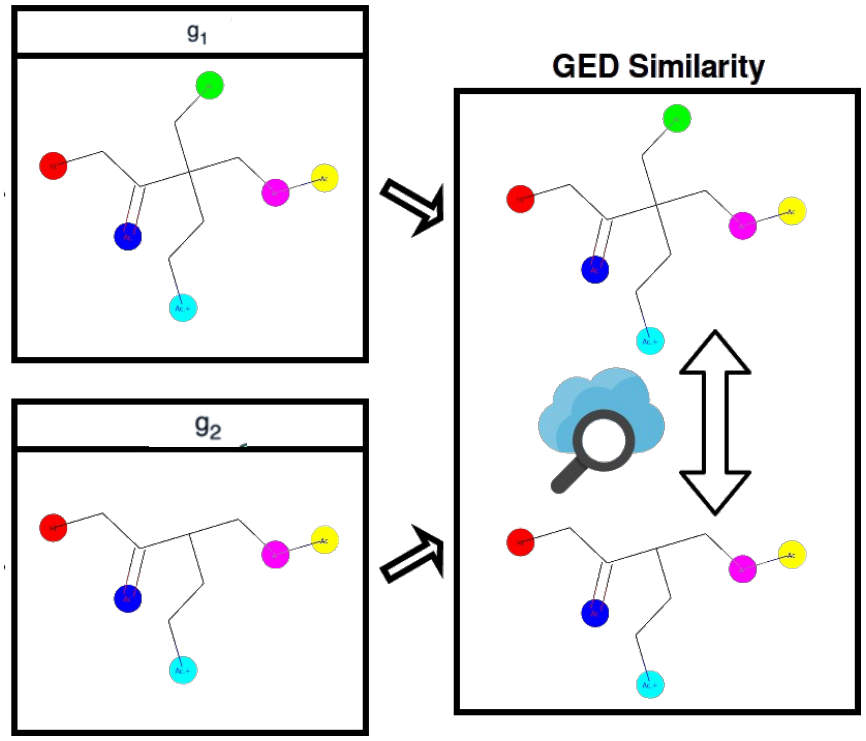
Graph Edit Distance

The Graph Edit Distance between two attributed graphs is defined as the transformation from one graph into another through edit operations.

These edit operations are: Substitution, deletion and insertion on nodes and edges. Every edit operation has a cost depending on their attributes.





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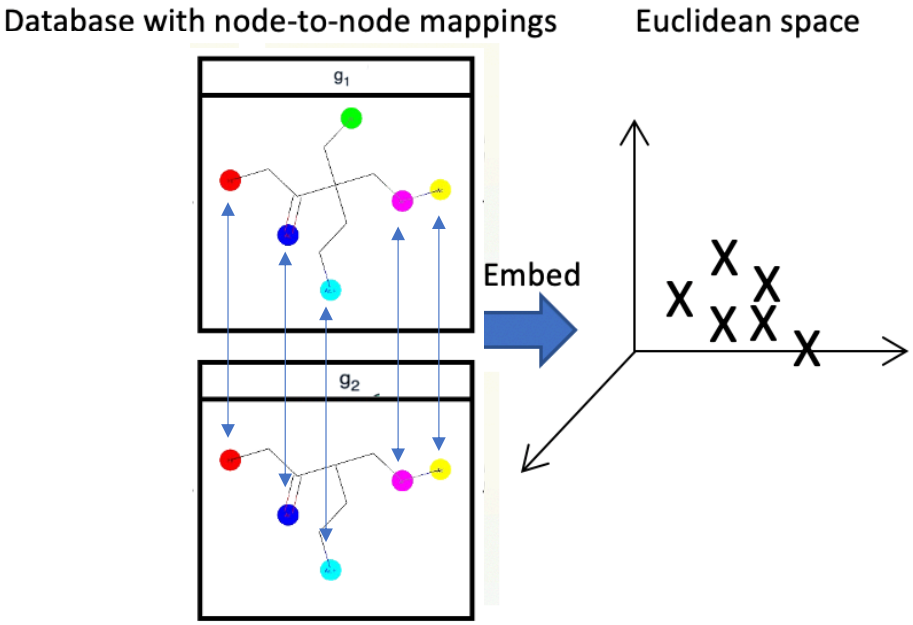
Learning model



Our **learning method** learns the weights on nodes and edges in two steps:

-**Embedding** the node-to-node mappings:

It embeds the ground truth node-to-node mappings into a Euclidean space.

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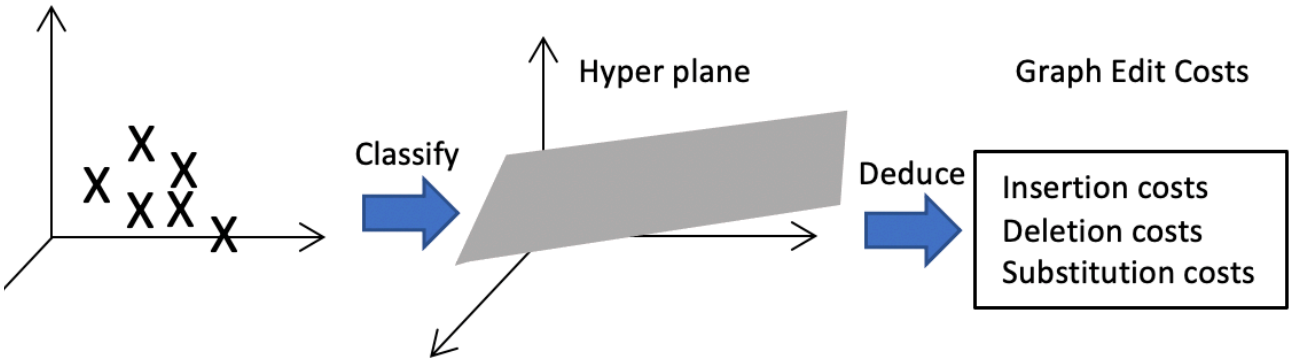
Learning model

-**Deducing a hyperplane**:

It computes a linear regression of the embedded points.

The hyperplane constants are the weights we want to learn.



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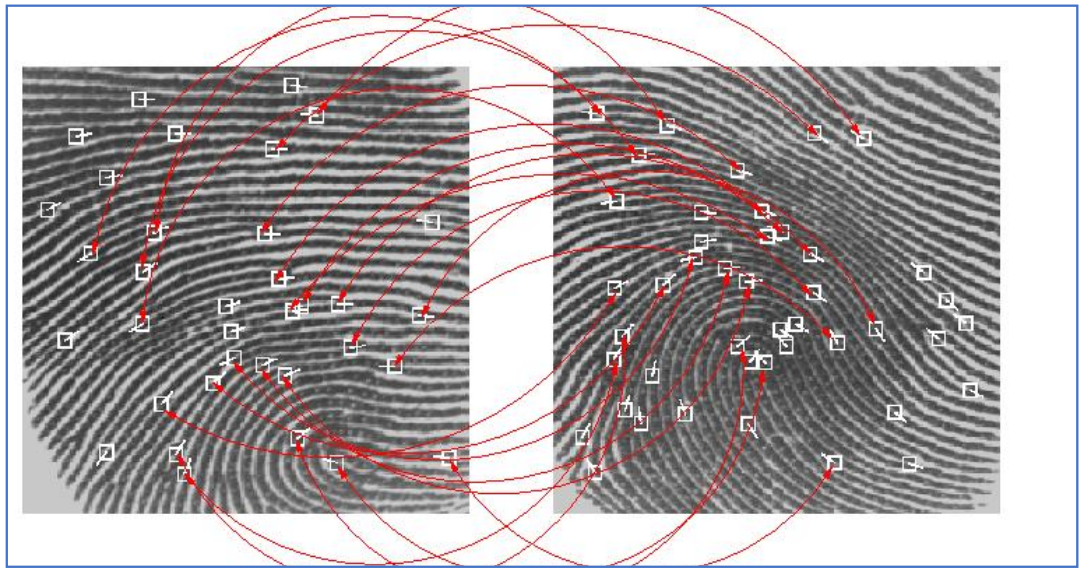
Experimental evaluation



Weights to be learn

$$D(m'_a, m_i) = \alpha \cdot sd(m'_a, m_i) + \beta \cdot dd(m'_a, m_i)$$

$$sd(m'_j, m_i) = \sqrt{(x'_j - x_i)^2 + (y'_j - y_i)^2}$$

$$dd(m'_j, m_i) = \min\{|\theta'_j - \theta_i|, 360^0 - |\theta'_j - \theta_i|\}$$

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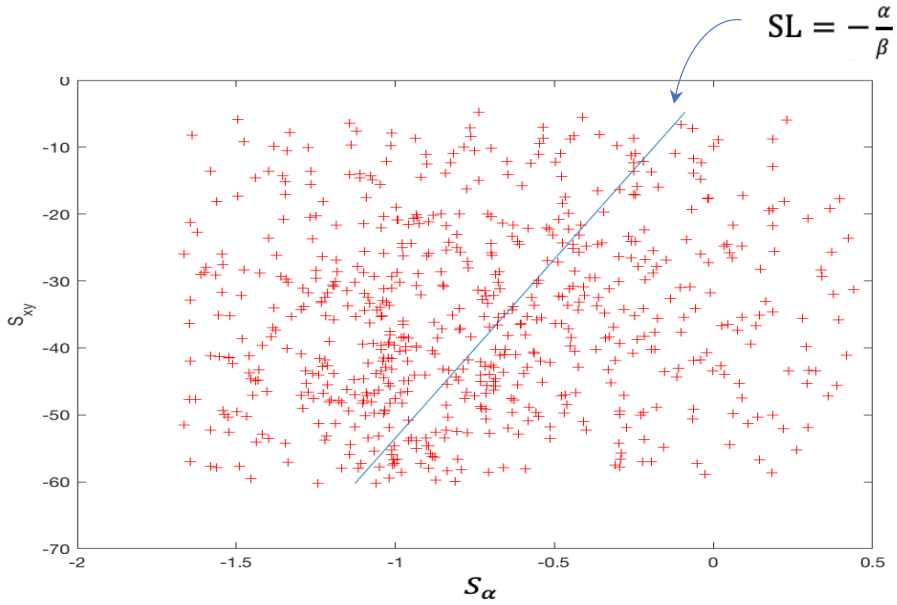

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Experimental evaluation

$$SL = -\frac{\alpha}{\beta}$$

CR: classification ratio
HD: Hamming distance

Method	DB	1	2	3	4	5	6	7	8	9	10	11	12
Our method 0.05sec	SL	30	39	43	53	36	40	40	42	35	38	47	56
	CR	**1**	**1**	0.98	0.91	**1**	**1**	**0.91**	0.80	**1**	0.91	**0.78**	**0.57**
	H	**0.01**	**0.05**	0.06	0.19	**0.07**	**0.10**	0.15	0.20	0.07	**0.12**	0.19	0.25
Leordeano 10 min	SL	28	39	46	52	38	40	40	44	29	37	45	63
	CR	.9	1	0.95	0.90	1	0.97	0.89	0.81	1	0.92	0.81	0.57
	H	0.03	0.15	0.16	0.22	0.09	0.11	0.12	0.18	0.07	0.2	0.18	0.23
Caetanu 5 min	SL	38	24	10	4	250	142	37	42	406	72	55	59
	CR	1	1	1	1	1	0.92	0.91	0.87	1	0.93	0.77	0.57
	H	0.01	0.04	0.03	0.08	0.08	0.14	0.15	0.18	0.06	0.12	0.19	0.25
Cortés 8 min	SL	30	39	Inf	Inf	36	41	Inf	42	-	-	48	64
	CR	1	1	0.12	0.03	1	1	0.01	0.8	-	-	0.78	0.55
	H	0.01	0.05	0.66	0.67	0.07	0.10	0.63	0.20	-	-	0.19	0.26