Force Direct Visualization for Phylogenetic Trees

ISEL
INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

Projeto e Seminário
Licenciatura em Engenharia Informática e Computadores

- **DEMO**

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INTRODUCTION

OUTLINE

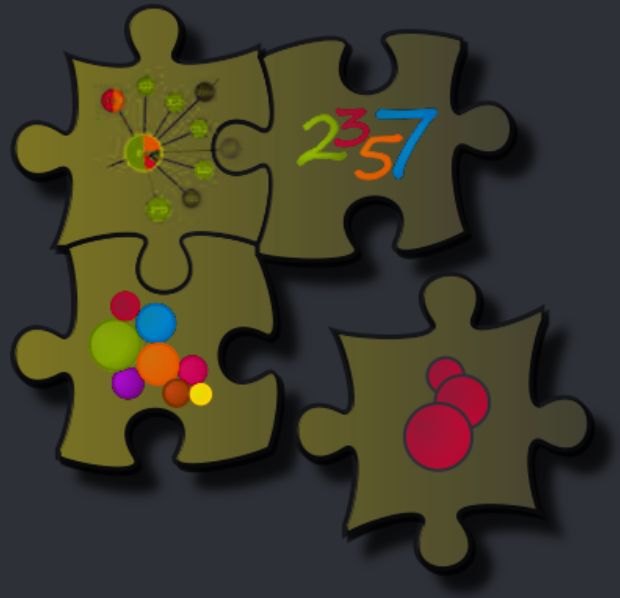
Chapter 1: Introduction to Phyloviz

Chapter 2: Problem Description

Chapter 3: Libraries

Chapter 4: Arquiteture

Chapter 5: Demo



1

PHYLOVIZ

Open-source platform provides analysis of sequence-based typing methods that generate allelic profiles from DNA sequencing

PHYLOVIZ

- Visualization of epidemiological data
- Visualization, analysis and manipulation of phylogenetic trees;
- Desktop Application;
- Online Application;

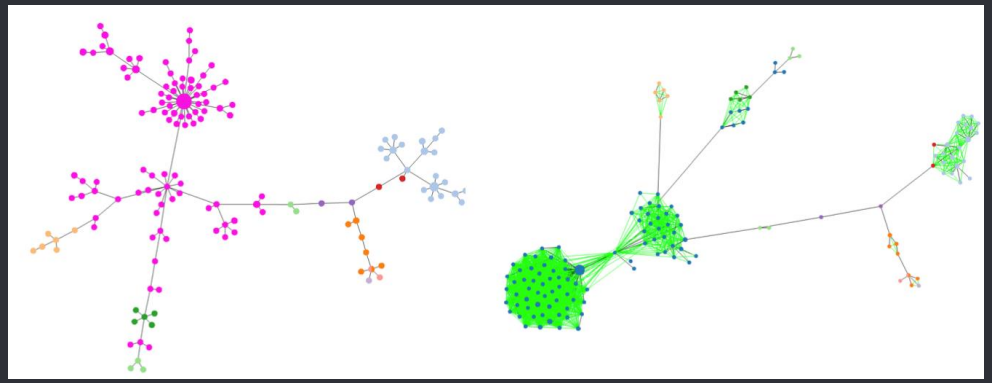


Fig. 1 – Phylogenetic tree force direct layout.

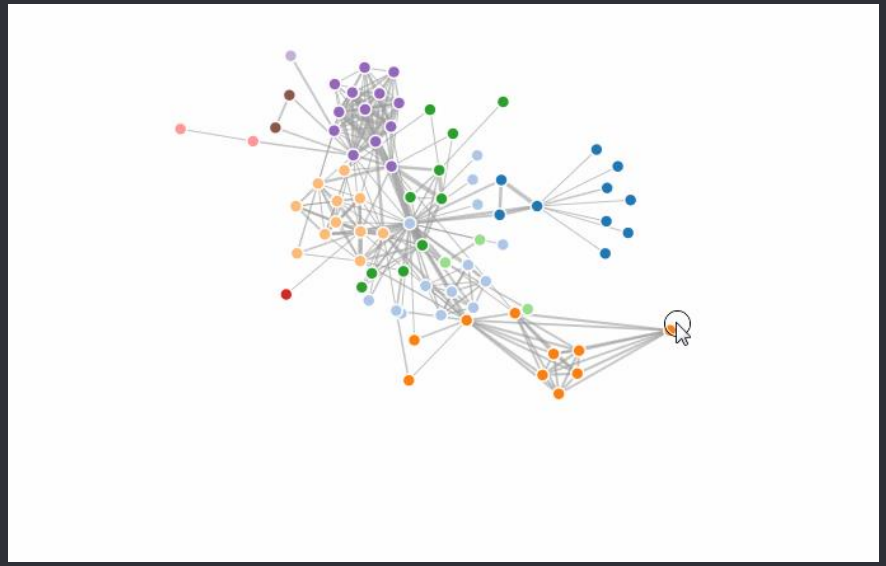
2

PROBLEM DESCRIPTION

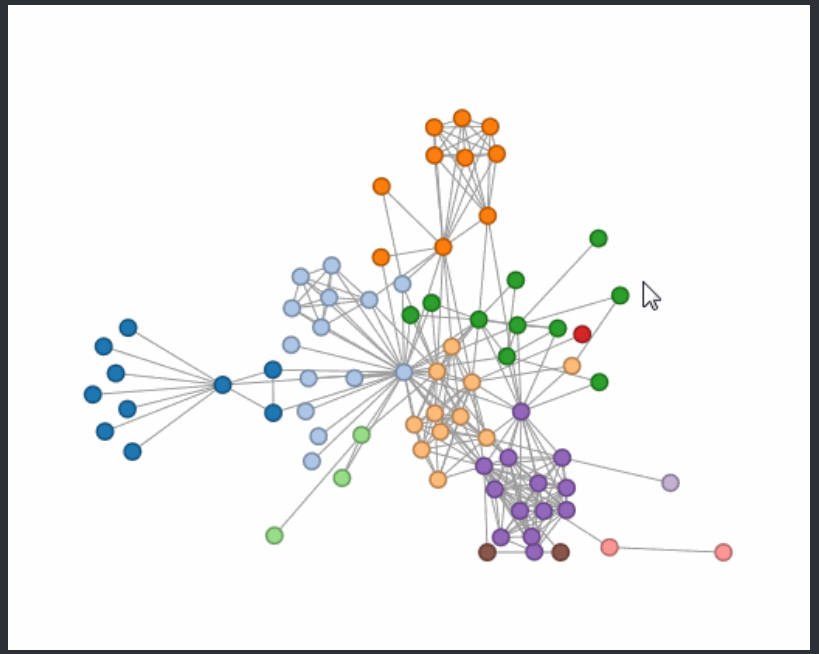
- Phyloviz-online
- Javascript, HTML & css
- Force Directed Layout

Force Direct Layout

- Algorithm for graphic drawing;
- Non-static visualization;
- Uses the information to simulate forces;



Features:



- Force Direct Layout
- Tables
- **Collapse & Expand**
- Pie-chart Graphics
- Labels
- Filters
- Complementary Data
- **Save state**

3 Libraries

3.1 Graph Drawing Libraries

Graph Drawing Libraries

- Supports SVG;
- Force graphic's functions;
- Allows node costumization;
- Allows to save nodes coordinates/positions;
- Active community;

Graphic Drawing Libraries

- Vivagraph JS
- D3

- Sigma JS

Performance: D3 vs Vivagraph JS

LIBRARY		Small Tree (200 nodes)			Medium Tree (5000 nodes)			Big Tree (16000 nodes)		
		Simple Graph	Simple Graphh with Labels	Graph with different renderig function	Simple Graph	Simple Graphh with Labels	Graph with different renderig function	Simple Graph	Simple Graphh with Labels	Graph with different rendering function
	D3	42,114	39,485	73,09499	922,624	992,91	813,764	6145,805	6190,83	5948,65
		49,5249	37,725	54,485	1109,75	1139,75	834,264	6297,03	6418,065	6289,819
		47,5549	46,345	42,025	1115,4	1350,785	824,674	5800,959	6762,765	5831,23
		44,509	55,945	52,3949	1091,535	957,655	820,345	5984,93	7577,865	5981,55
		45,8899	46,05	56,635	878,924	959,405	773,499	6309,464	6523,765	5895,764
		45,919	45,11	55,726978	1023,6466	1080,101	813,3092	6107,6376	6694,658	5989,4026
	VivaGraph	86,8099	152,86	124,875	3067,41	5817,273	1089,474	29518,494	27646,529	6430,465
		83,92	102,249	103,994	3238,979	5443,006	1380,4149	26149,529	27022,234	6990,349
		80,8899	101,73	114,2949	2948,72	4254,264	1216,224	26234,884	31673,945	6262,255
		104,744	110,699	100,785	3140,705	4119,51	1270,08	26053,139	32669,13	6200,584
		121,035	101,985	98,019	3469,559	3390,664	1182,629	26718,135	26532,074	5713,779
		95,47976	113,9046	108,39358	3173,0746	4604,9434	1227,76438	26934,8362	29108,7824	6319,4864

Fig. 2 – Vivagraph JS and D3 performance results, in ms.

4 ARQUITETURE

Modules

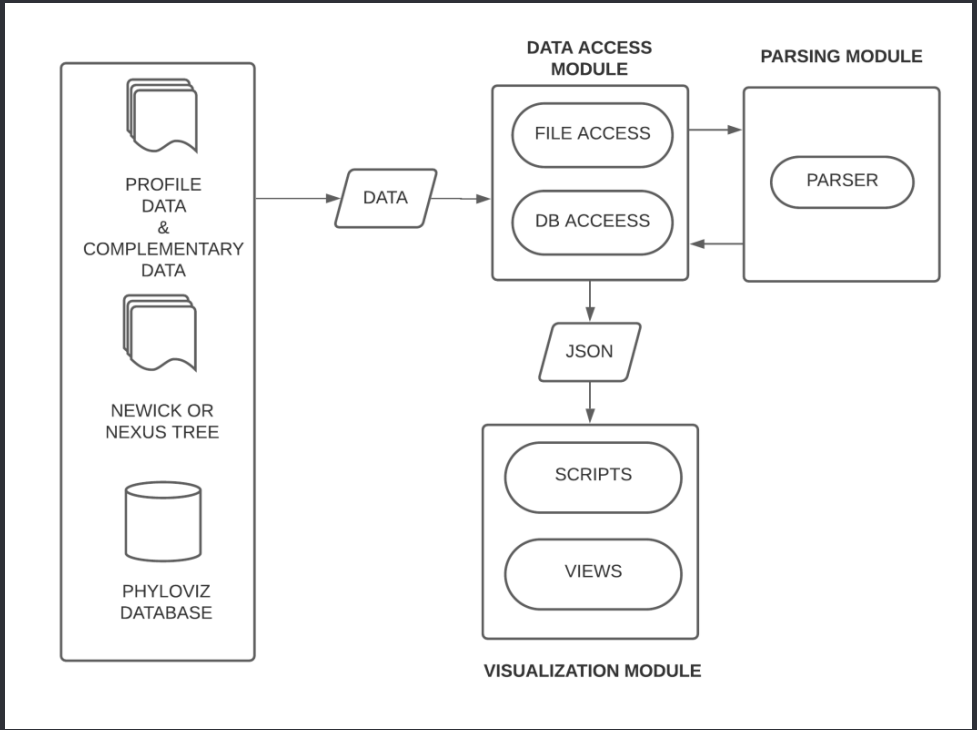


Fig. 3 – Arquiteture diagram.

DATA ACCESS MODULE – FILE INPUT

Fig. 4 – Tree in Newick format.

id	aroE	ddl	gdh	gki	recP	spi	xpt
1	1	1	1	1	1	1	1
2	2	1	2	2	2	2	1
3	10	5	31	4	34	6	4
4	4	1	4	2	4	4	1
5	1	3	5	4	1	5	3

Fig. 5 – Profile Data.

id	isolate	aliases	country	year	serotype
1	NCTC11906-19F	NCTC11906	UK	1978	19F
2	SAF-17244-19	17244	South Africa		19
3	PJ23/1	PJ23	Sweden	1992	1
4	SP264-23F	264	Spain	1984	23F
5	87-029044-14	87-029044	Slovakia	1987	14

Fig. 6 – Complementary Data.

Parsing Modules

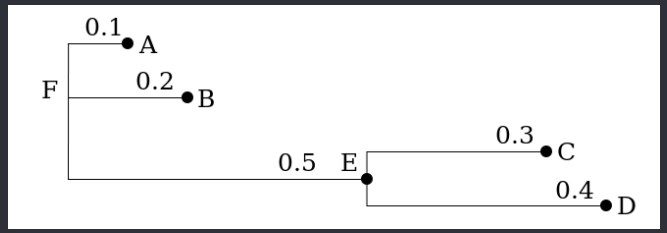
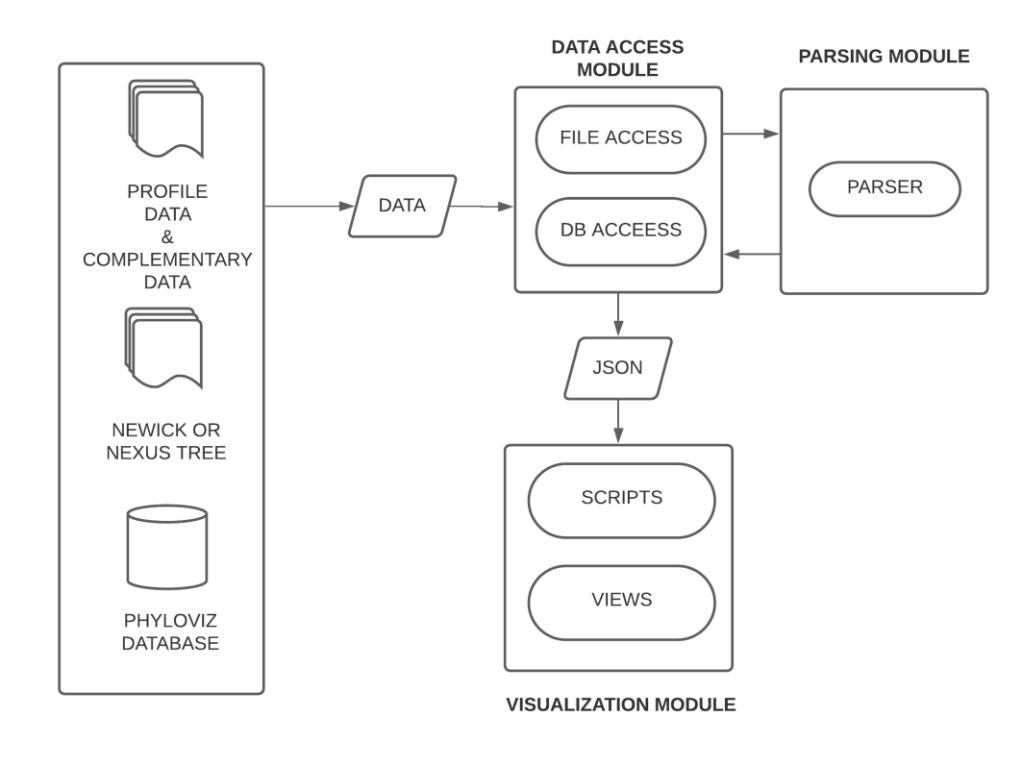


Fig. 7 Newick Tree.

```
"nodes": [
    {"name": "A","length": 0.1} ,
    {"name": "B", "length": 0.2} ,
    {"name": "C","length": 0.3} ,
    {"name": "D", "length": 0.4} ,
    {"name": "E", "branchset": [...], "length": 0.5} ,
    {"name": "F", "branchset": [...] }
]
"links": [
    {"source": "F", "target": "A"} ,
    {"source": "F", "target": "B"} ,
    {"source": "F", "target": "E"} ,
    {"source": "E", "target": "C"} ,
    {"source": "E", "target": "D"}
]
```

Fig. 8 JSON output of parsing module.

Modules


PROFILE DATA & COMPLEMENTARY DATA
NEWICK OR NEXUS TREE
PHYLOVIZ DATABASE
DATA
DATA ACCESS MODULE
FILE ACCESS
DB ACCEESS
PARSING MODULE
PARSER
JSON
SCRIPTS
VIEWS
VISUALIZATION MODULE

5 DEMO