PRESENTATION - GRAPH NEURAL NETWORKS FOR NEXT POINT OF INTEREST RECOMMENDATION

Deep Learning

Master's Degree in Computer Science

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Dataset

1 Task and data analysis

Task: given a sequence of check-ins we want to predict where the user will go

Columns

1. Venue (ID-Name)
2. User
3. Category (Name)
4. Location (Longitude-Altitude)
5. Timestamp

The dataset comprises

- 227,428 check-ins
- 38,333 venues
- 398 distinct categories
- 1,083 users
- time range 2012 - 2013

New features - Grid and Hotness

1 Task and data analysis

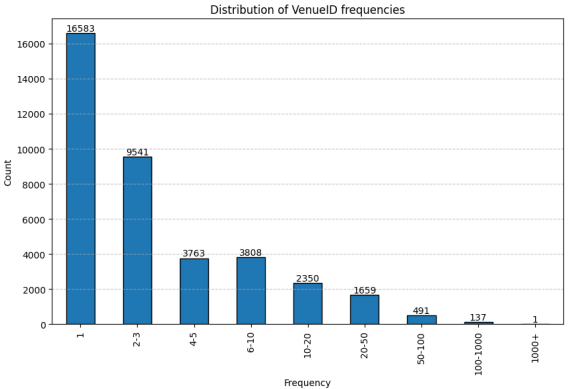
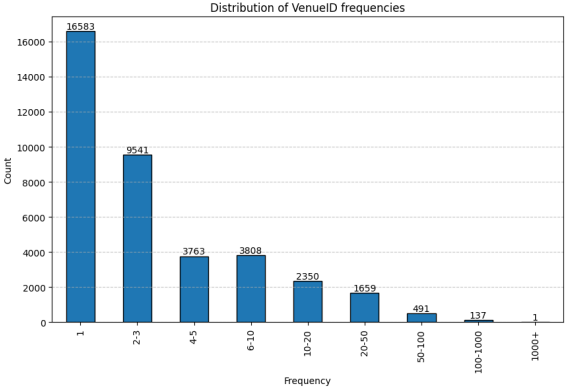


Figure: Analysis of the distribution of venues' check-ins

1. **Hotness:** based on the popularity of the venue (0-6)
2. **Grid:** based on the coordinates of the place we obtained 336 different grid values

Label discrimination

1 Task and data analysis



Number of labels

$$38{,}333 \xrightarrow{-33{,}198} 5135$$

Figure: Analysis of the distribution of venues' check-ins

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2 Sequences study and definition

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Sequence creation

- We grouped check-ins by user and ordered them in a ascending fashion
- A sequence is defined of a set of ordered check-ins, where each adjacent pair has a time $\Delta \leq 1$ day
- The last is the element of the set is a label

Top_1	Top_5	Top_10	Top_20
17.10	38.50	46.10	52.20

Table: U Top score

Number of sequences: 33,023
Number of 1 element sequences: 10,889

Sequences' problem resolution

1. Removed sequences with $length < 4$
2. Take a random venue in the sequence as label

	Top_1	Top_5	Top_10	Top_20
Init. Sequences	17.10	38.50	46.10	52.20
Mod. Sequences	4.13	9.95	12.00	13.42

Table: U Top score

Sequences to Graph

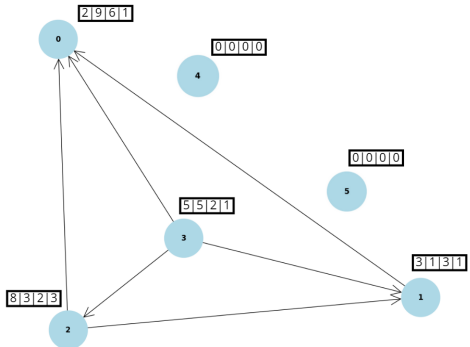

Figure: Graph representation of the 'venues-id' sequence [5, 8, 3, 2] with a maximum sequence length of six.

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3 Model architecture and results

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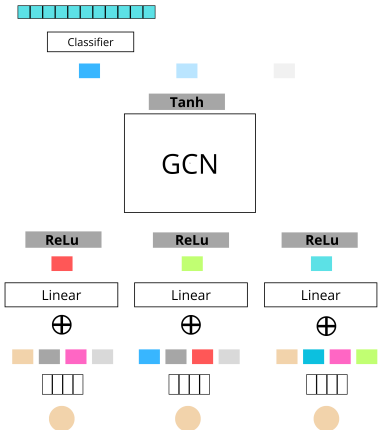
Model architecture

3 Model architecture and results



Model hyper-parameters

Hyperparameter	Value
Learning Rate	0.0001
Batch Size	128
Optimizer	Adam
Loss Function	Cross Entropy
Dropout Rate	0.25
Units per Hidden Layer	512
Activation Function	Relu, Tanh

Results

3 Model architecture and results

Model	Top-1	Top-5	Top-10	Top-20	MRR
U-TOP-10-WRL	4.13	9.95	12.00	13.42	n/d
LSTM	7.33	14.10	16.64	19.46	10.47
Model-10-WRL	7.75	19.88	24.68	29.05	13.45

Table: Performance Metrics for Different Models

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Thank you for listening!