



201: Image recognition at scale with PostgreSQL

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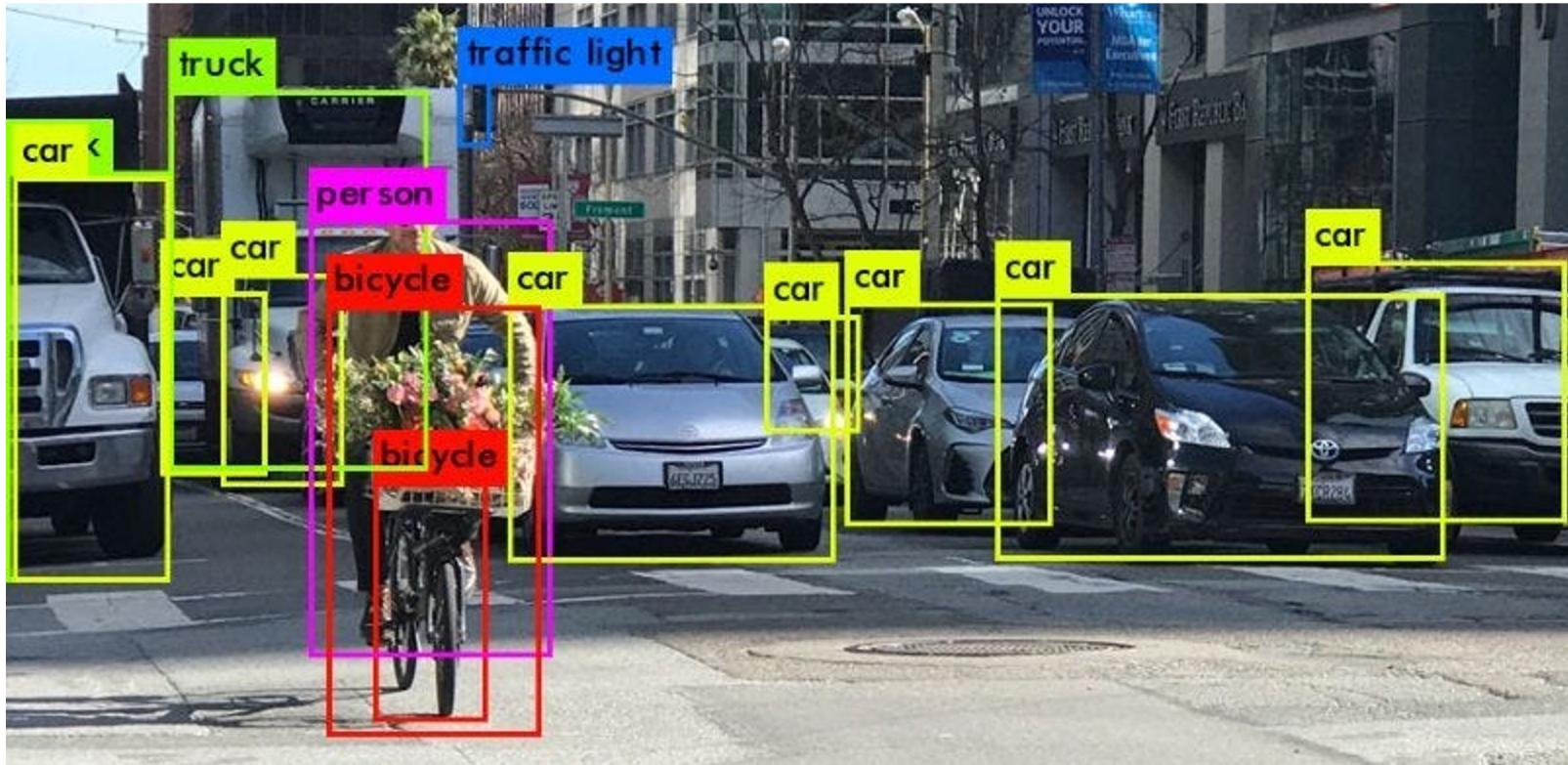


Agenda

- What is image recognition
- Use cases
- What's behind image recognition
- Image recognition pipeline
- Why PostgreSQL

What is Image recognition?

Image recognition



Use cases

Use cases

- Automated Labelling
- Visual Similarity Search
- Access Control
- Surveillance
- Anomaly detection



Embeddings, not only for images

- Chats
- Documentation
- Movies
- Generative AI

What's behind Image recognition?

Image definition



157	153	174	168	150	152	129	161	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	106	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	168	139	76	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	106	36	190
205	174	155	252	236	231	149	178	228	43	95	234
180	216	116	149	236	187	85	150	79	38	218	241
190	224	147	108	227	210	127	101	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	236	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

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188	88	179	209	185	215	211	168	139	76	20	169
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183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

Embedding

A relatively
low-dimensional space
into which
you can translate
high-dimensional vectors

Image to Embeddings

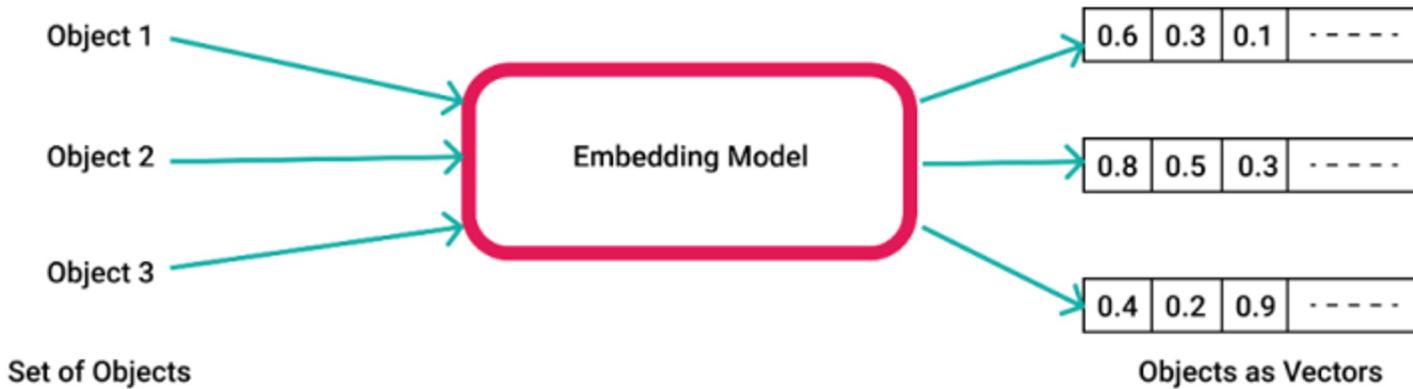


Image to embedding



Image recognition pipeline Example

Image recognition data pipeline

Starting Picture

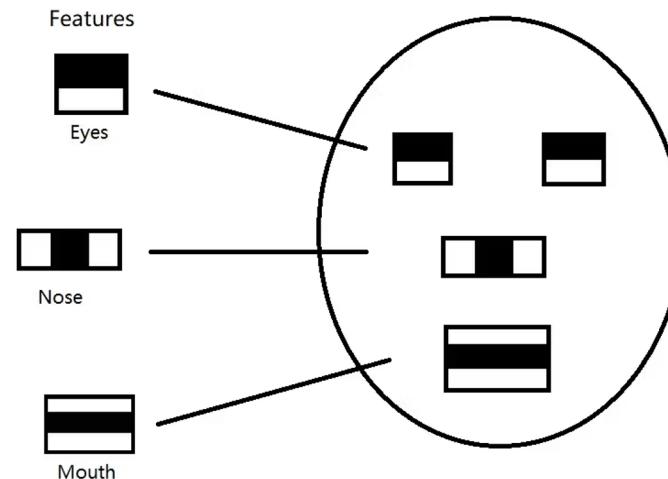


What do we need?

- Face detection
- Embeddings calculation
- Embeddings storage
- Similarity Search

Face Detection

● OpenCV - Haar Cascade Model



Embeddings calculation

- imgbeddings
 - OpenAI CLIP model
 - Hugging Face transformers

<https://github.com/minimaxir/imgbeddings>

What do we need?

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PostgreSQL



PostgreSQL

PGVector

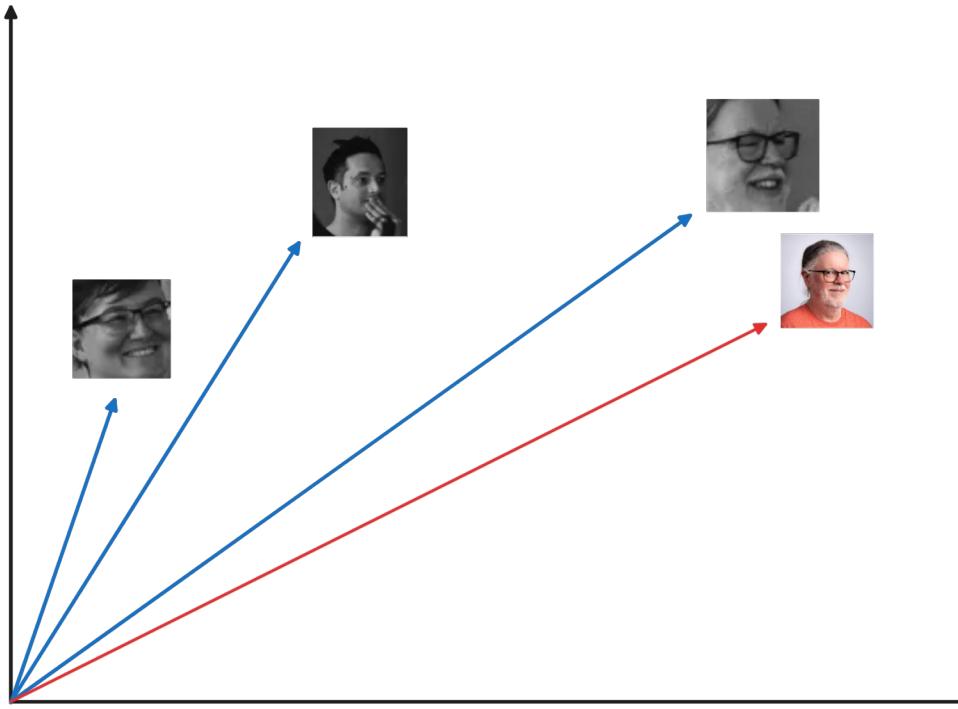
- Open Source vector similarity search for PostgreSQL
 - Approximate nearest neighbor search
 - Trade accuracy and performance
 - L2 distance, inner product, and cosine distance

<https://github.com/pgvector/pgvector>

Vector similarity query

```
SELECT picture  
FROM pictures  
ORDER BY  
embedding <-> '[1, 0.6656, 0.9888, ...]'
```

Vector similarity in PostgreSQL



Why PostgreSQL?

PostgreSQL benefits

- Wide adoption
- Open source
- You are already using PostgreSQL
 - Existing skillset
 - Existing tooling for Backup/Recovery

Take PostgreSQL to the next level

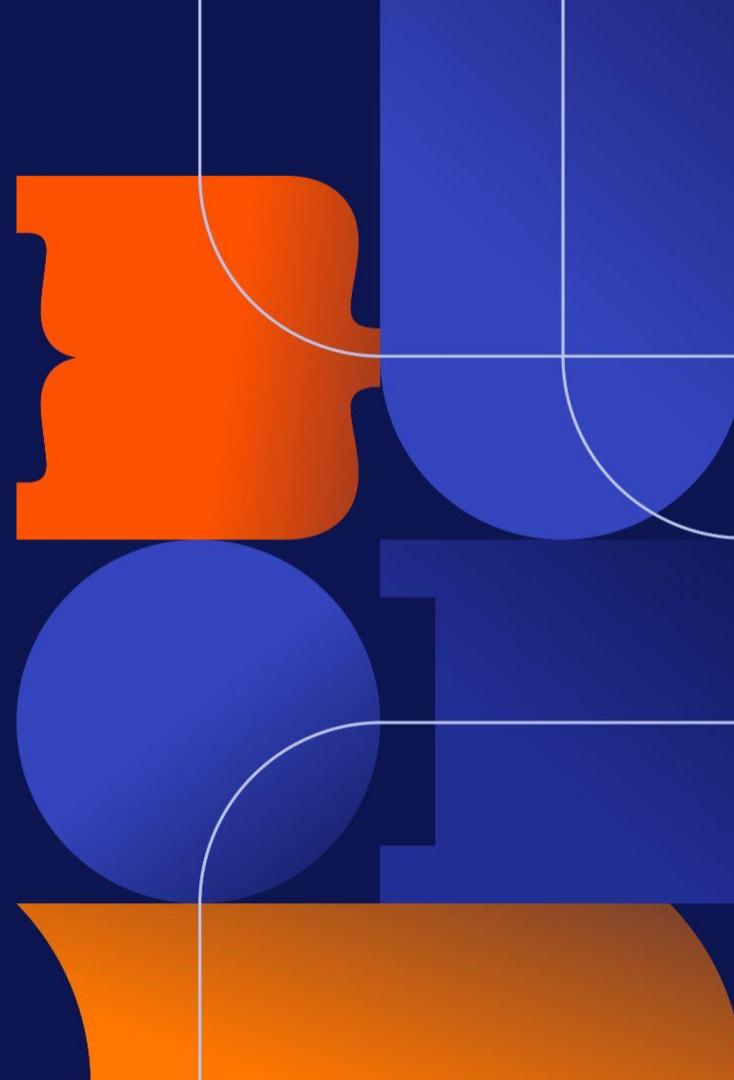
- Optimised embeddings storage
- Indexes for optimised search

Mix standard and vector queries

- Add similarity search to your operational queries



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