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Spring AI

Generative Artificial Intelligence con Java

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Corso avanzato per Venis S.p.A, Venezia, Italia

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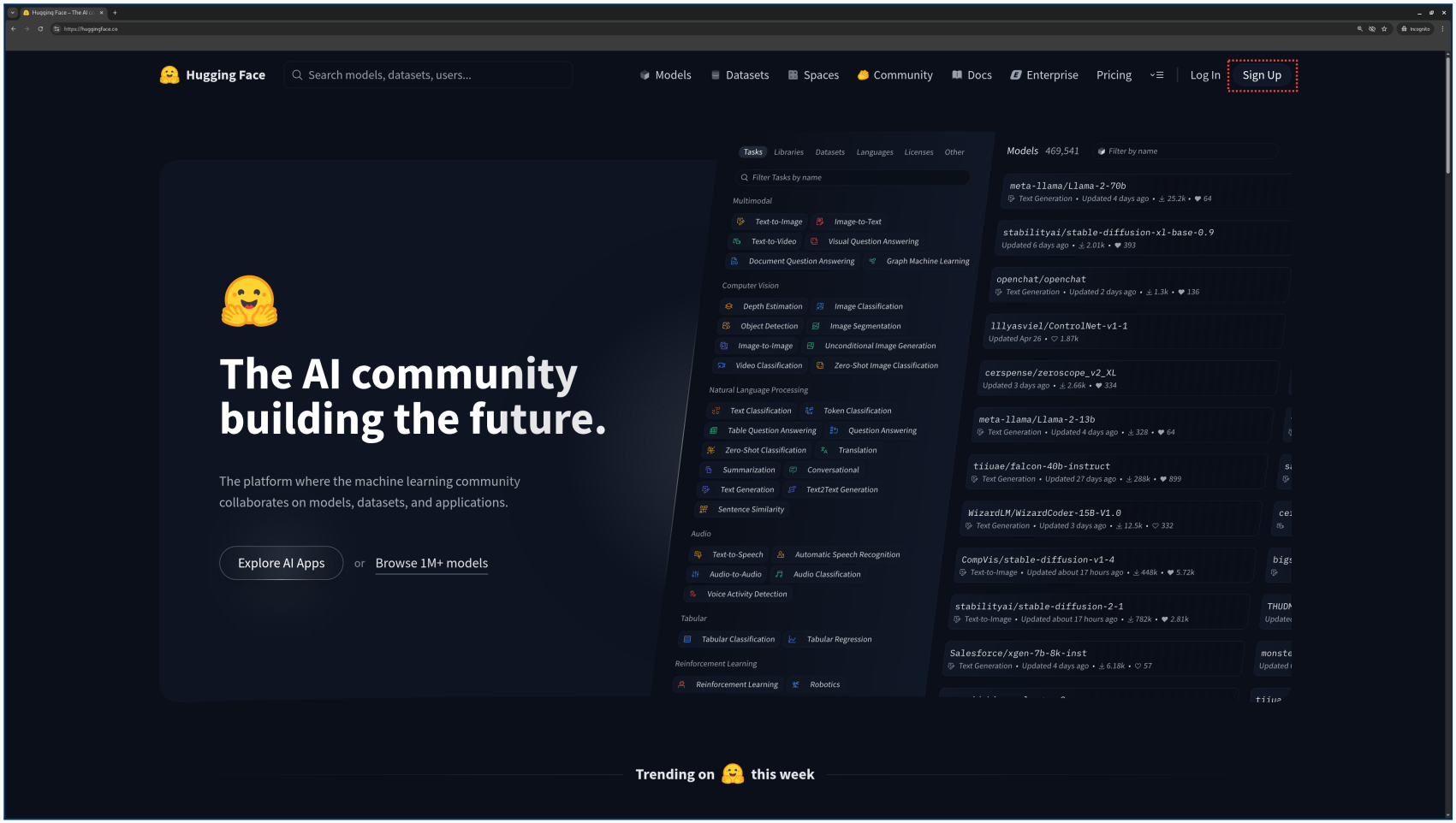
Retrieval Augmented Generation

Parte 1

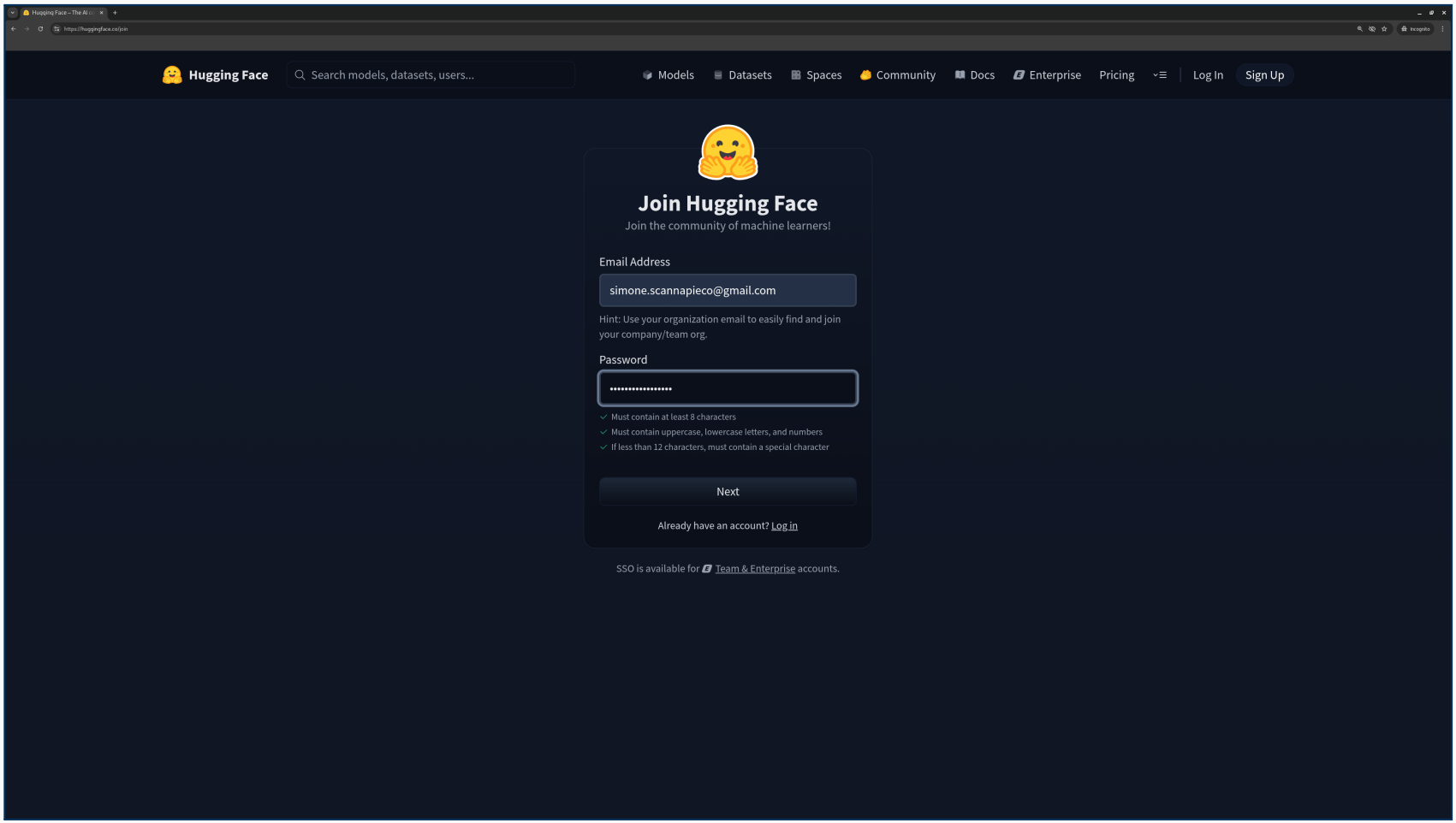
- Storico della conversazione valida per singola sessione

- Configurazione *JDBC H2 chat memory* per `ChatClient` Ollama
  1. Modifica al `pom.xml` per dipendenze Spring AI JDBC, H2 e *devtools*
  2. Modifica ad `application.yml`
  3. Creazione schema H2
  4. Modifica ai *bean* `ChatClient` per Ollama
  5. *Test* delle funzionalità con Postman/Insomnia

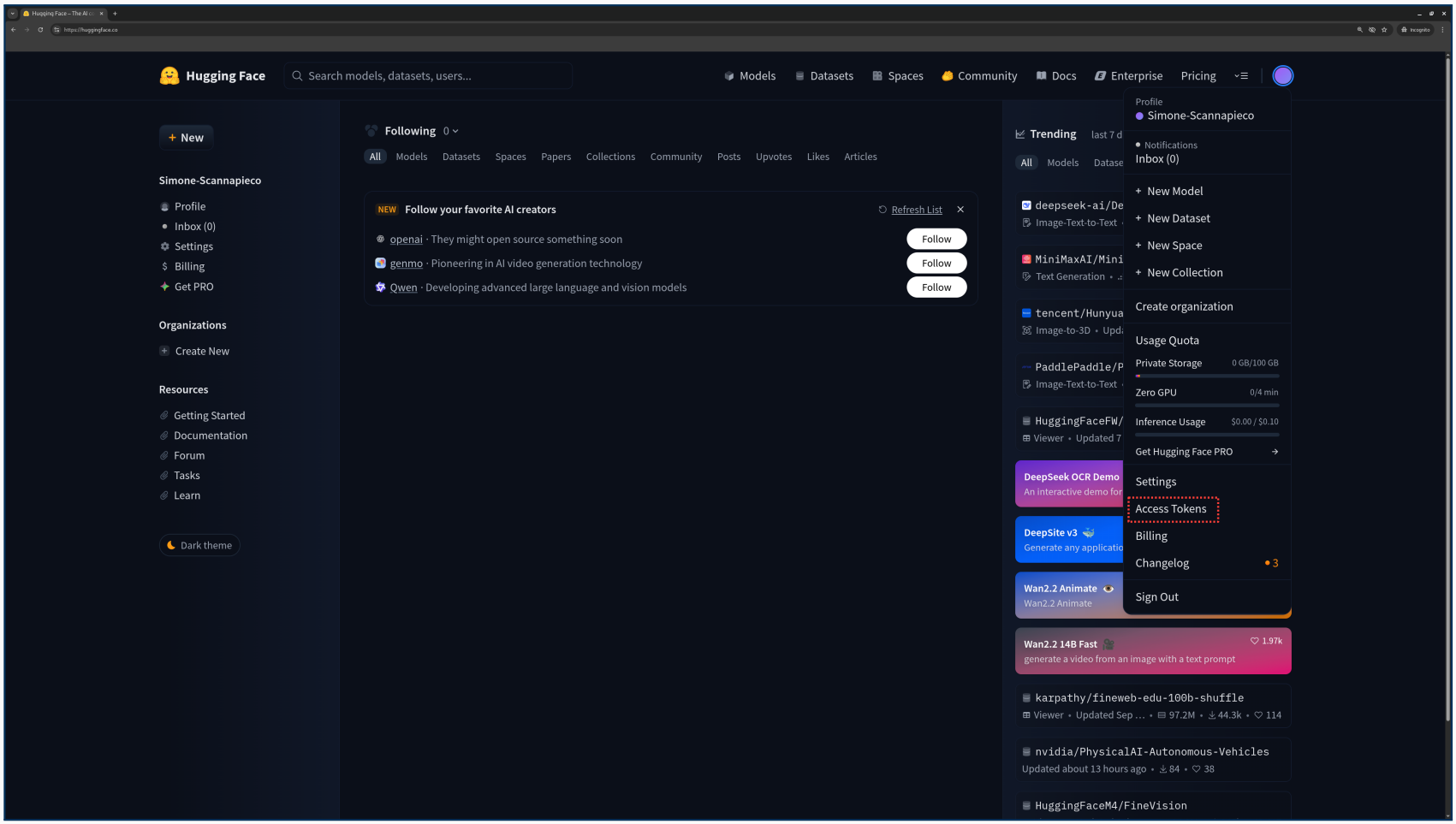
1. Accedere al portale `https://huggingface.co/`



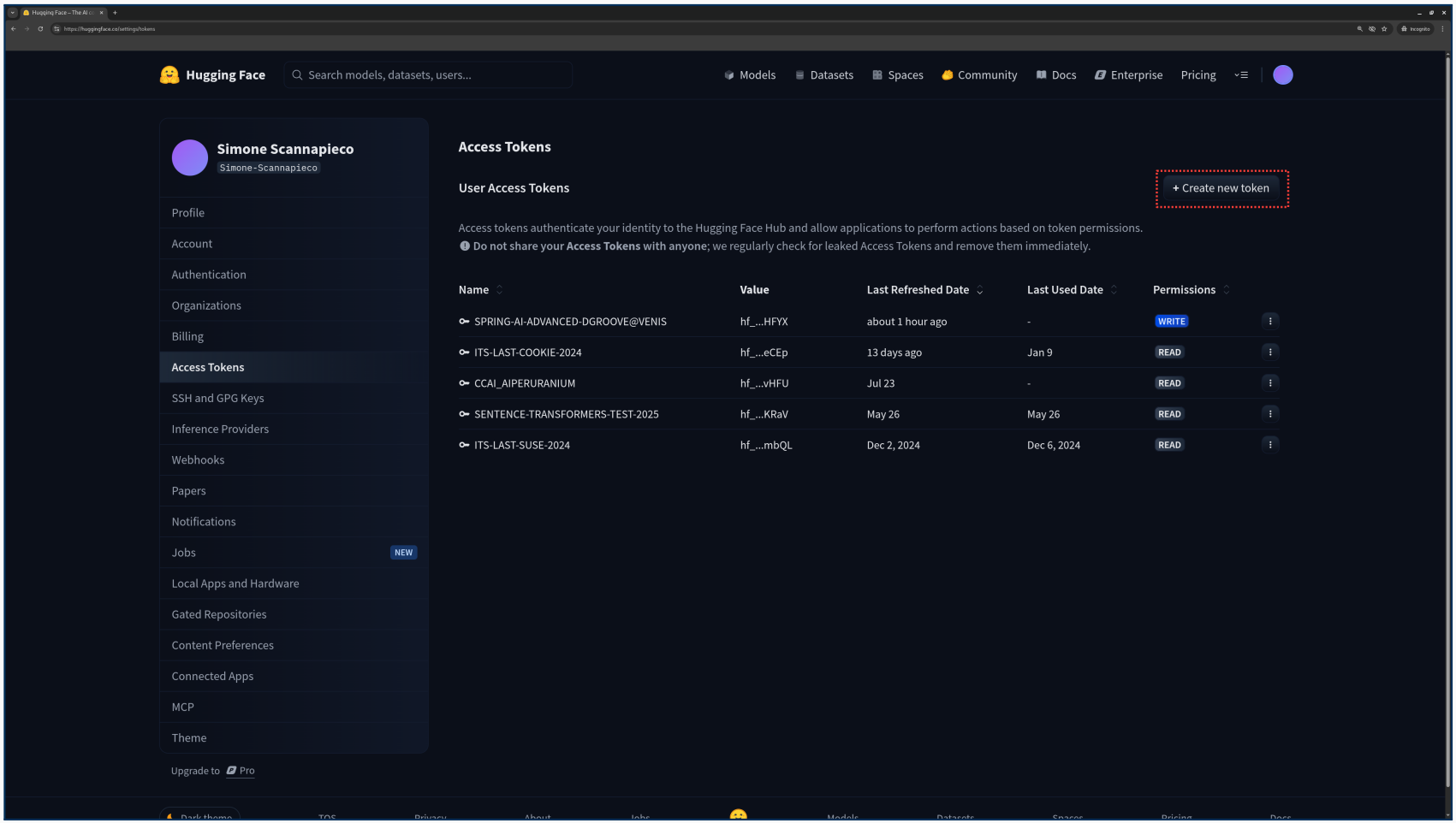
2. Creare una nuova utenza premendo il pulsante `Sign up`



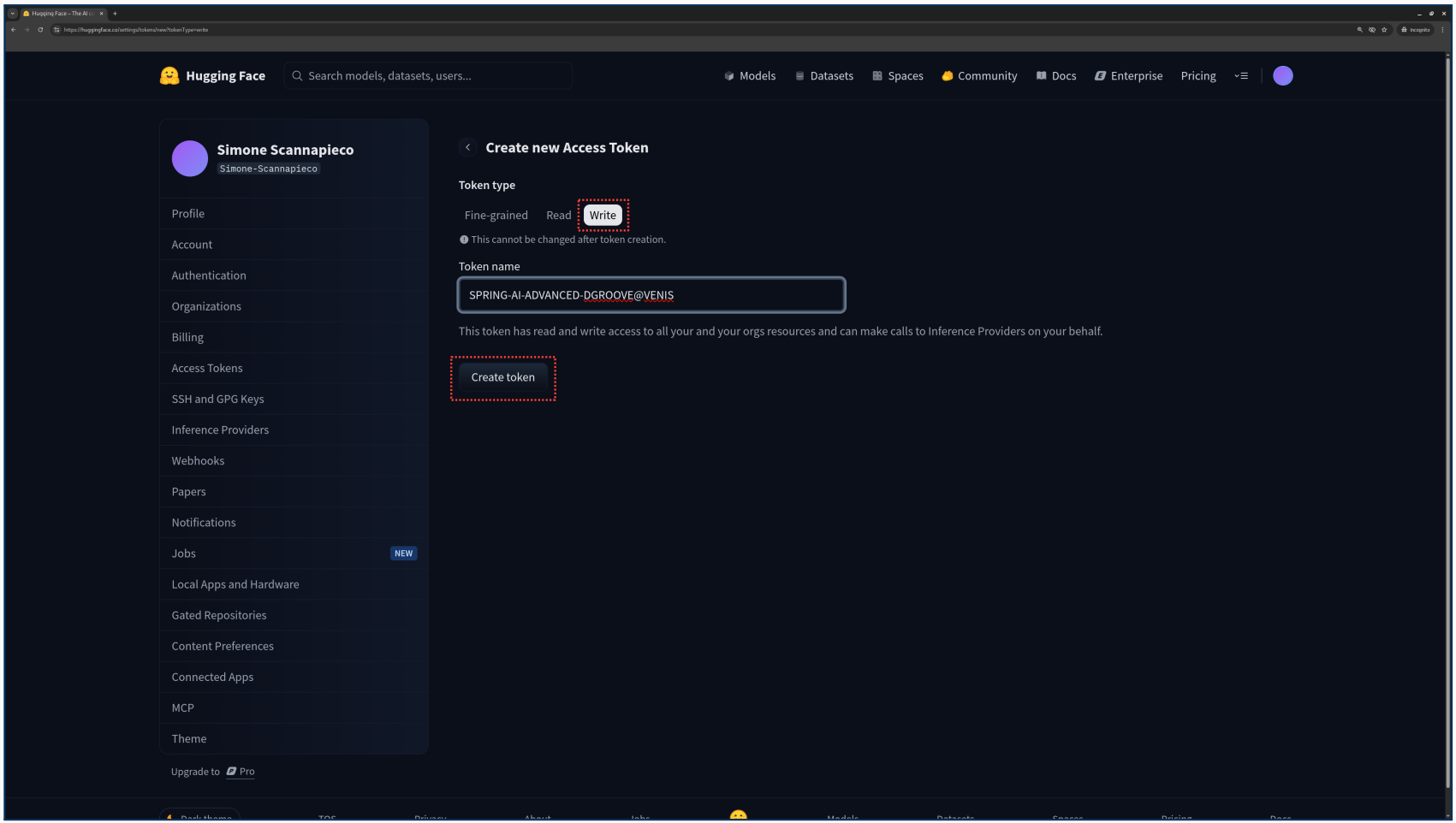
3 Accedere al portale e selezionare `Access tokens` nel menu in alto a destra



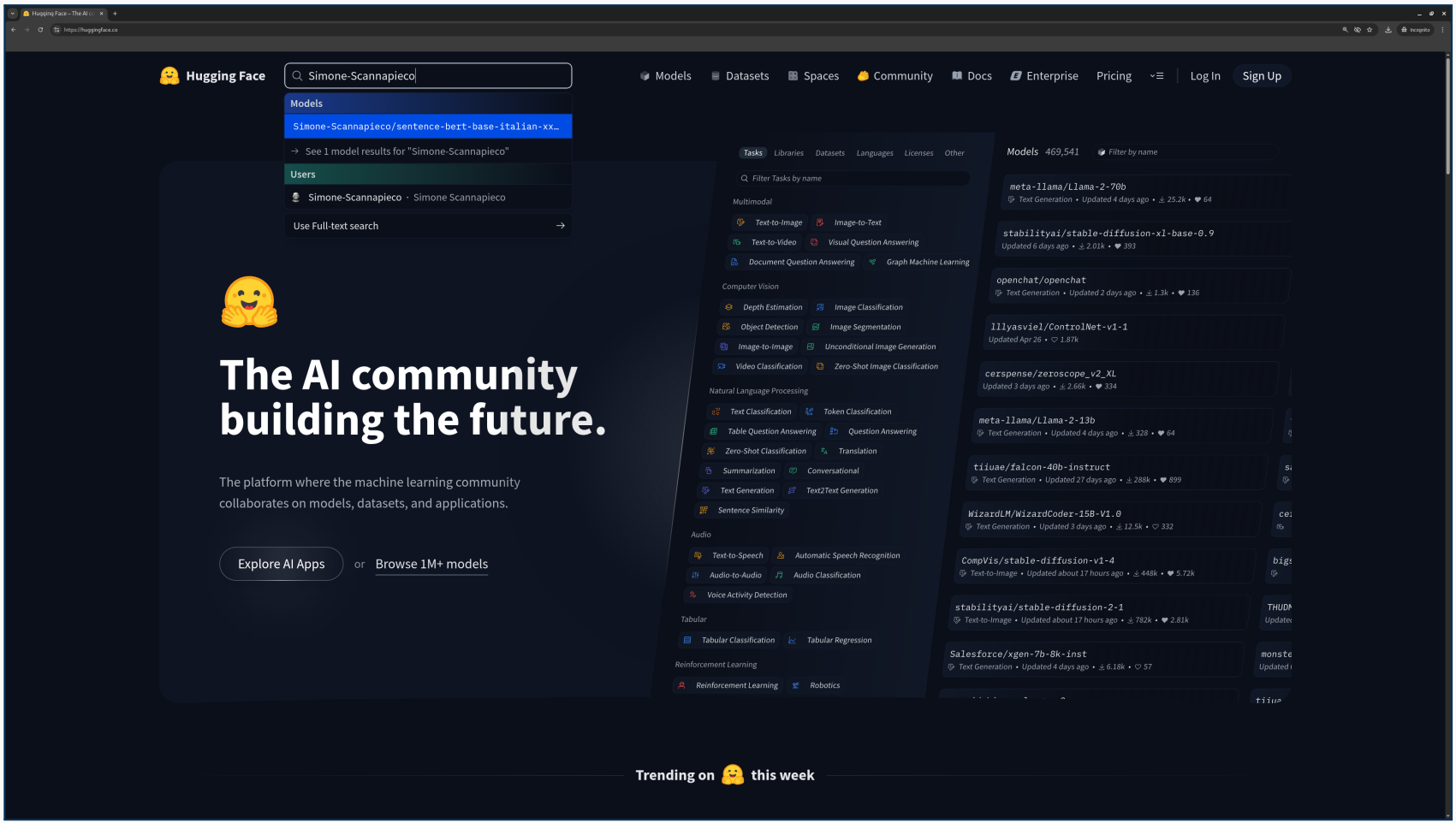
4 Premere sul pulsante `Create new token`



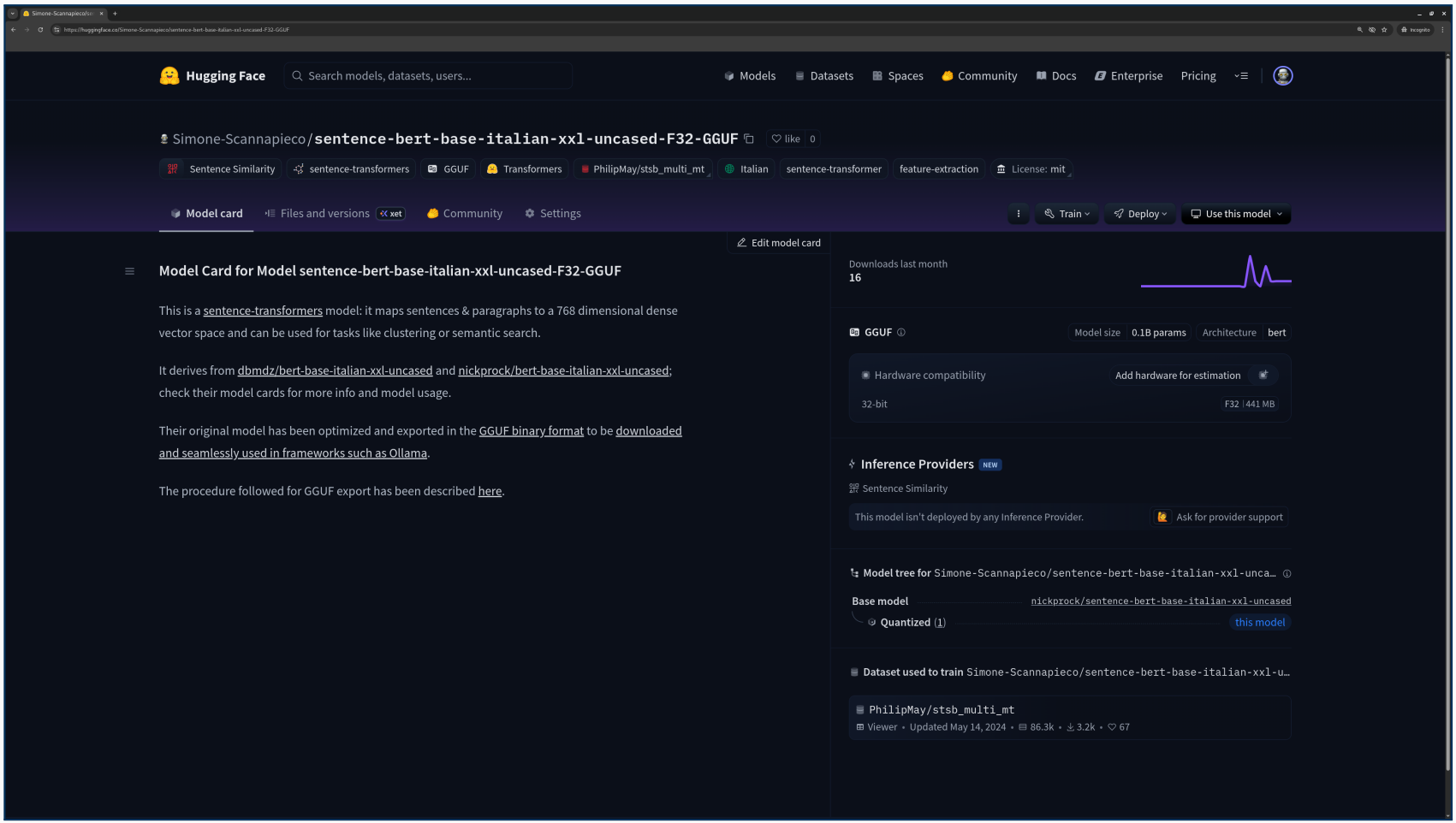
5 Selezionare *token* di tipo `Write`, denominare il *token* e premere `Create token`



6 Cercare il modello di *embedding*, leggendone la *card*



6 Cercare il modello di *embedding*, leggendone la *card*



File `launch.json`

```
{
    // Use IntelliSense to learn about possible attributes.
    // Hover to view descriptions of existing attributes.
    // For more information, visit: https://go.microsoft.com/fwlink/?linkid=830387
    "version": "0.2.0",
    "configurations": [
        {
            "type": "java",
            "name": "Launch Current File",
            "request": "launch",
            "mainClass": "${file}"
        },
        {
            "type": "java",
            "name": "DemoApplication",
            "request": "launch",
            "mainClass": "it.venis.ai.spring.demo.DemoApplication",
            "projectName": "demo",
            "env": {
                "GOOGLE_AI_API_KEY": "...",
                "HUGGING_FACE_HUB_TOKEN": "..."
            }
        }
    ]
}
```

File `settings.json`

```
{
    "java.compile.nullAnalysis.mode": "disabled",
    "java.configuration.updateBuildConfiguration": "interactive",
    "java.test.config": {
        "env": {
            "GOOGLE_AI_API_KEY": "...",
            "HUGGING_FACE_HUB_TOKEN": "..."
        }
    }
}
```

File `docker-compose.yml`

```yaml
services:
  ...
  spring-ai-vector-store:
    image: qdrant/qdrant:${QDRANT_VERSION:-latest}
    hostname: spring-ai-vector-store
    container_name: spring_ai_vector_store
    ports:
      - ${QDRANT_HTTP_PORT:-6333}:6333
      - ${QDRANT_GRCP_PORT:-6334}:6334
    volumes:
      - spring_ai_vector_store:/qdrant/storage
    restart: unless-stopped

volumes:
  ...
  spring_ai_vector_store:
    name: spring_ai_vector_store
```

File spring-ai.env

```
...
# qdrant configuration
QDRANT_VERSION=v1.13.0                                  # default: latest
QDRANT_HTTP_PORT=6333                                     # default: 6333
QDRANT_GRCP_PORT=6334                                     # default: 6334
```

Dipendenze di sistema aggiuntive

```
...
<dependency>
        <groupId>org.springframework.ai</groupId>
        <artifactId>spring-ai-rag</artifactId>
</dependency>
<dependency>
        <groupId>org.springframework.ai</groupId>
        <artifactId>spring-ai-advisors-vector-store</artifactId>
</dependency>
<dependency>
        <groupId>org.springframework.ai</groupId>
        <artifactId>spring-ai-starter-vector-store-qdrant</artifactId>
</dependency>
...
```

Configurazione applicativo

```yaml
spring:
    ...
    autoconfigure:
        exclude:
        - org.springframework.ai.vectorstore.qdrant.autoconfigure.QdrantVectorStoreAutoConfiguration
        # We must disable Vector Store auto-configuration because of two different EmbeddingModel beans
        # (OpenAI-Gemini and Ollama). The goal is to have two different vector collections, one for each
        # family of LLM.
    ai:
        ollama:
            ...
            embedding:
                model: hf.co/Simone-Scannapieco/sentence-bert-base-italian-xxl-uncased-F32-GGUF
        openai:
            ...
            embedding:
                options:
                    model: gemini-embedding-001
        vectorstore:
            qdrant:
                initialize-schema: true
                host: 172.17.0.1
                port: 6334
    ...
```

File `erase_llm_volumes.sh`

```
#!/bin/bash

volume_name=spring_ai_llm

docker volume rm $volume_name
```

File `erase_vector_store_volumes.sh`

```
#!/bin/bash

volume_name=spring_ai_vector_store

docker volume rm $volume_name
```

File get-rag-data-system-ita-prompt.st

```
Sei un assistente AI in grado di rispondere alle domande dell'utente solo in base
al contesto fornito dalla sezione DOCUMENTI.
Se la risposta non è presente nella sezione DOCUMENTI, informa l'utente di non
sapere la risposta.

DOCUMENTI: <documenti>
```

File get-rag-data-system-eng-prompt.st

```
You are an helpful assistant, answering questions based on the given context in
the DOCUMENTS section and no prior knowledge.
If the answer is not in the DOCUMENTS section, then reply that you cannot answer
to the question.

DOCUMENTS: <documenti>
```

Configurazione Vector Store - I

```
package it.venis.ai.spring.demo.config;

import org.springframework.ai.embedding.EmbeddingModel;
import org.springframework.ai.openai.OpenAiEmbeddingModel;
import org.springframework.ai.vectorstore.VectorStore;
import org.springframework.ai.vectorstore.qdrant.QdrantVectorStore;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.beans.factory.annotation.Qualifier;
import org.springframework.beans.factory.annotation.Value;
import org.springframework.context.annotation.Bean;
import org.springframework.context.annotation.Configuration;

import io.qdrant.client.QdrantClient;
import io.qdrant.client.QdrantGrpcClient;

@Configuration
public class RAGConfig {

    @Autowired
    public OpenAiEmbeddingModel openAiEmbeddingModel;

    @Autowired
    public EmbeddingModel ollamaEmbeddingModel;

    @Value("${spring.ai.vectorstore.qdrant.host:#{null}}")
    private String qdrantHost;
    @Value("${spring.ai.vectorstore.qdrant.port:#{null}}")
    private String qdrantPort;
    @Value("${spring.ai.vectorstore.qdrant.use-tls:#{null}}")
    private String useTls;

    ...
```

Configurazione Vector Store - II

```
...
@Bean
public QdrantClient qdrantClient() {
    QdrantGrpcClient.Builder grpcClientBuilder = QdrantGrpcClient.newBuilder(
            qdrantHost == null ? "localhost" : qdrantHost,
            qdrantPort == null ? 6334 : Integer.valueOf(qdrantPort),
            useTls == null ? false : Boolean.valueOf(useTls));
    return new QdrantClient(grpcClientBuilder.build());
}

@Value("${spring.ai.vectorstore.qdrant.collection-name.gemini:#{null}}")
private String qdrantCollectionNameGemini;
@Value("${spring.ai.vectorstore.qdrant.collection-name.ollama:#{null}}")
private String qdrantCollectionNameOllama;
@Value("${spring.ai.vectorstore.qdrant.initialize-schema:#{null}}")
private String qdrantInitializeSchema;

@Bean
public VectorStore geminiVectorStore(QdrantClient qdrantClient,
        @Qualifier("openAiEmbeddingModel") EmbeddingModel geminiEmbeddingModel) {
    return QdrantVectorStore.builder(qdrantClient, geminiEmbeddingModel)
        .collectionName(qdrantCollectionNameGemini == null ? "vector_store_gemini" : qdrantCollectionNameGemini)
        .initializeSchema(qdrantInitializeSchema == null ? false : Boolean.valueOf(qdrantInitializeSchema))
        .build();
}

@Bean
public VectorStore ollamaVectorStore(QdrantClient qdrantClient,
        @Qualifier("ollamaEmbeddingModel") EmbeddingModel ollamaEmbeddingModel) {
    return QdrantVectorStore.builder(qdrantClient, ollamaEmbeddingModel)
        .collectionName(qdrantCollectionNameOllama == null ? "vector_store_ollama" : qdrantCollectionNameOllama)
        .initializeSchema(qdrantInitializeSchema == null ? false : Boolean.valueOf(qdrantInitializeSchema))
        .build();
}}
```

Componente popolamento Qdrant

```
package it.venis.ai.spring.demo.rag;

import java.util.List;
import java.util.stream.Collectors;

import org.springframework.ai.document.Document;
import org.springframework.ai.vectorstore.SearchRequest;
import org.springframework.ai.vectorstore.VectorStore;
import org.springframework.beans.factory.annotation.Qualifier;
import org.springframework.stereotype.Component;

import jakarta.annotation.PostConstruct;

@Component
public class TextDataLoader {

    private final VectorStore geminiVectorStore;
    private final VectorStore ollamaVectorStore;

    public TextDataLoader(@Qualifier("geminiVectorStore") VectorStore geminiVectorStore,
            @Qualifier("ollamaVectorStore") VectorStore ollamaVectorStore) {
        this.geminiVectorStore = geminiVectorStore;
        this.ollamaVectorStore = ollamaVectorStore;

    }

    @PostConstruct
    public void loadVenisInfoIntoVectorStore() {
        List<String> venisInfo = List.of(
                "VENIS SpA, acronym for Venice Informatics and Systems, is the ICT services company and local electronic commun

                "The legal and main operational headquarters of VENIS SpA is located in the prestigious Palazzo Ziani, situated
```

Interfaccia servizio

```
package it.venis.ai.spring.demo.services;

import it.venis.ai.spring.demo.model.Answer;
import it.venis.ai.spring.demo.model.QuestionRequest;

public interface RAGService {

    public Answer getGeminiRAGTextToVectorStoreAnswer(QuestionRequest request);

    public Answer getOllamaRAGTextToVectorStoreAnswer(QuestionRequest request);

}
```

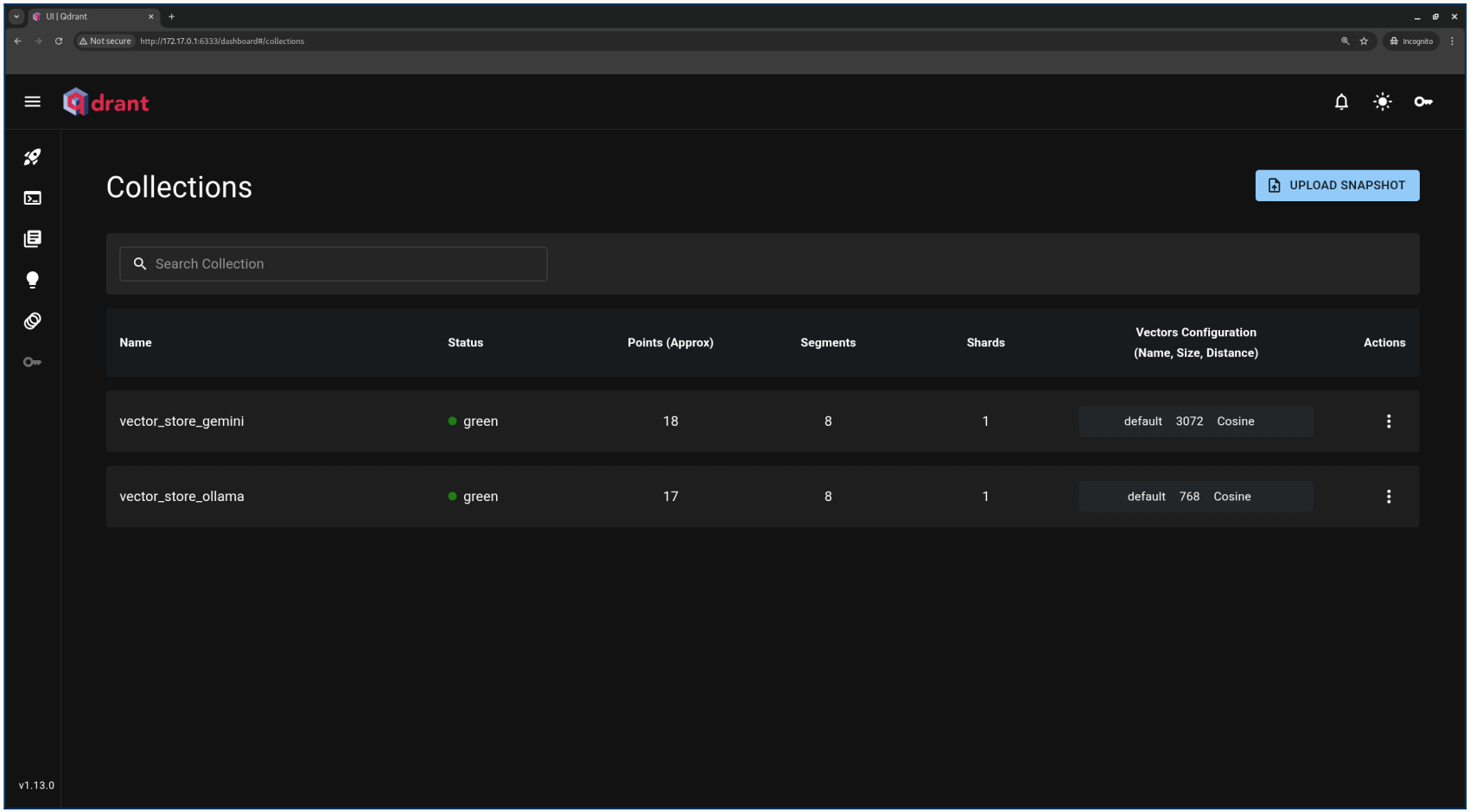
Implementazione servizio

```
package it.venis.ai.spring.demo.services;

import java.util.List;
import java.util.Map;
import java.util.stream.Collectors;

import org.springframework.ai.chat.client.ChatClient;
import org.springframework.ai.chat.memory.ChatMemory;
import org.springframework.ai.document.Document;
import org.springframework.ai.template.st.StTemplateRenderer;
import org.springframework.ai.vectorstore.SearchRequest;
import org.springframework.ai.vectorstore.VectorStore;
import org.springframework.beans.factory.annotation.Qualifier;
import org.springframework.beans.factory.annotation.Value;
import org.springframework.context.annotation.Configuration;
import org.springframework.core.io.Resource;
import org.springframework.stereotype.Service;

import it.venis.ai.spring.demo.model.Answer;
import it.venis.ai.spring.demo.model.QuestionRequest;

@Service
@Configuration
public class RAGServiceImpl implements RAGService {

    private final ChatClient geminiChatClient;
    private final ChatClient ollamaChatClient;
    private final ChatClient ollamaMemoryChatClient;
    private VectorStore geminiVectorStore;
    private VectorStore ollamaVectorStore;

    public RAGServiceImpl(
            @Qualifier("geminiChatClient") ChatClient geminiChatClient,
            @Qualifier("ollamaChatClient") ChatClient ollamaChatClient,
            @Qualifier("ollamaMemoryChatClient") ChatClient ollamaMemoryChatClient,
            @Qualifier("geminiVectorStore") VectorStore geminiVectorStore,
            @Qualifier("ollamaVectorStore") VectorStore ollamaVectorStore) {
```

Implementazione controllore REST

```
package it.venis.ai.spring.demo.controllers;

import org.springframework.web.bind.annotation.PostMapping;
import org.springframework.web.bind.annotation.RequestBody;
import org.springframework.web.bind.annotation.RestController;

import it.venis.ai.spring.demo.model.Answer;
import it.venis.ai.spring.demo.model.Question;
import it.venis.ai.spring.demo.model.QuestionRequest;
import it.venis.ai.spring.demo.services.QuestionService;
import it.venis.ai.spring.demo.services.RAGService;

@RestController
public class QuestionController {

    private final QuestionService service;
    private final RAGService ragService;

    public QuestionController(QuestionService service, RAGService ragService) {

        this.service = service;
        this.ragService = ragService;

    }

    @PostMapping("/gemini/ask")
    public Answer geminiAskQuestion(@RequestBody Question question) {

        return this.service.getGeminiAnswer(question);

    }

    @PostMapping("/ollama/ask")
    public Answer ollamaAskQuestion(@RequestBody Question question) {

        return this.service.getOllamaAnswer(question);
```

1. Verificare la *dashboard* Qdrant (`http://172.17.0.1:6333/dashboard`)



https://github.com/simonescannapieco/spring-ai-advanced-dgroove-venis-code.git

Branch: 7-spring-ai-gemini-ollama-rag-text-to-vector-store