Софийски университет “Св. Климент Охридски”

Факултет по математика и информатика

Проект

по

“Представяне и моделиране на знания”

на тема

“Онтология за храни”

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30.01.2023 г.

1. Идея на проекта

Идеята на проекта е да се моделират в онтология понятия от предметната област на храните. Крайните цели са:

- Лесно разширяване на онтологията с нови храни (бърза класификация)
- Бързо търсене на храни по зададени от потребител критерии

2. Елементи на онтологията

2.1. Класове

Атомарни класове
Dish ⊑ Thing
PlaceOfOrigin ≐ {Bulgaria} ⊔ {Japan} ⊔ {Asia} ⊔ {Mexico}
Ingredient ⊑ Thing

Съставки
GlutenFree ≐ [AND Ingredient **[FILLS :has_gluten False]]**
Meat ⊑ GlutenFree
Chicken ⊑ Meat
Beef ⊑ Meat
Pork ⊑ Meat
Fish ⊑ GlutenFree
Vegetable ⊑ GlutenFree
Dairy ⊑ GlutenFree
Egg ⊑ GlutenFree
Flour ⊑ Ingredient
Fruit ⊑ GlutenFree

Ястия
Salad ≐ [AND Dish **[FILLS :is_cooked False]** **[FILLS :is_sweet False]** **[xs:maxInclusive :is_prepared_for 20]]**

MainDish ≐ [AND Dish **[FILLS :is_cooked True]** **[FILLS :is_sweet False]]**
Soup ≐ [AND Dish **[FILLS :is_liquid True]]**
CreamSoup ≐ [AND Soup **[FILLS :is_pureed True]]**
Dessert ≐ [AND Dish **[FILLS :is_sweet True]]**
Cake ≐ [AND Dessert **[EXISTS :has_ingredient Flour]]**
FruitCake ≐ [AND Cake **[EXISTS :has_ingredient Fruit]]**
VegetarianDish ≐ [AND Dish **[NOT EXISTS :has_ingredient Meat]** **[NOT EXISTS :has_ingredient Fish]]**
VeganDish ≐ [AND VegetarianDish **[NOT EXISTS :has_ingredient Dairy]** **[NOT EXISTS :has_ingredient Egg]]**
BulgarianDish ≐ [AND Dish **[FILLS :is_dish_in_region Bulgaria]]**
AsianDish ≐ [AND Dish **[FILLS :is_dish_in_region Asia]]**
JapaneseDish ≐ [AND Dish **[FILLS :is_dish_in_region Japan]]**
MexicanDish ≐ [AND Dish **[FILLS :is_dish_in_region Mexico]]**

2.2. Свойства

2.2.1. Свойства на обектите

Domain	Property	Range	Characterisitics
PlaceOfOrigin	is_in_region	PlaceOfOrigin	Transitive property, reflexive property
PlaceOfOrigin	has_subregion	PlaceOfOrigin	Transitive property, reflexive property, inverse property (of is_in_region)

Dish	is_dish_in	PlaceOfOrigin	-
PlaceOfOrigin	has_dish	Dish	Inverse property (of is_dish_in)
Dish	is_dish_in_region	PlaceOfOrigin	Property chain of is_dish_in and is_in_region
Dish	has_ingredient	Ingredient	-
Ingredient	is_ingredient_in	Dish	Inverse property (of has_ingredient)

2.2.2. Свойства на данните

Domain	Property	Range	Characteristics
Dish	is_sweet	bool	Functional property
Dish	is_prepared_for	int	Functional property
Dish	is_cooked	bool	Functional property
Dish	is_liquid	bool	Functional property
Ingredient	has_gluten	bool	Functional property
Meat	is_raw	bool	Functional property
Soup	is_pureed	bool	Functional property

2.3. Индивиди

Bulgaria → PlaceOfOrigin
Asia → PlaceOfOrigin
Japan → [AND PlaceOfOrigin
[FILLS :is_in_region Asia]]
Mexico → PlaceOfOrigin

ChickenWing → Chicken
ChickenLeg → Chicken
ChickenFillet → Chicken
WholeChicken → Chicken

BeefSteak → Beef

Bacon → Pork
PorkRibs → Pork
PorkSteak → Pork

Salmon → Fish

Tomato → Vegetable
Cucumber → Vegetable
Pepper → Vegetable
Carrot → Vegetable
Potato → Vegetable
Onion → Vegetable
Avocado → Vegetable
Broccoli → Vegetable
Zucchini → Vegetable

CowMilk → Dairy
Cheese → Dairy
Yogurt → Dairy
Butter → Dairy

ChickenEgg → Egg
QuailEgg → Egg

AllPurposeFlour → [AND Flour
[FILLS :has_gluten True]]
GlutenFreeFlour → [AND Flour
[FILLS :has_gluten False]]

Apple → Fruit
Plum → Fruit
Pear → Fruit
Banana → Fruit
Pumpkin → Fruit

BakingPowder → GlutenFree
CocoaPowder → GlutenFree
VanillaExtract → GlutenFree
WhiteSugar → GlutenFree
BrownSugar → GlutenFree
Cinnamon → GlutenFree
Ginger → GlutenFree
PumpkinSeeds → GlutenFree
Salt → GlutenFree
BlackPepper → GlutenFree
VegetableOil → GlutenFree
Water → GlutenFree
Rice → GlutenFree

Brownies → [AND Dessert
[FILLS :is_cooked True]
[FILLS :is_prepared_for 60]
[FILLS :has_ingredient AllPurposeFlour]
[FILLS :has_ingredient BakingPowder]
[FILLS :has_ingredient Butter]
[FILLS :has_ingredient CocoaPowder]
[FILLS :has_ingredient VanillaExtract]
[FILLS :has_ingredient WhiteSugar]]

AppleCinnamonMuffin → [AND FruitCake
[FILLS :is_cooked True]
[FILLS :is_prepared_for 45]
[FILLS :has_ingredient Apple]
[FILLS :has_ingredient GlutenFreeFlour]
[FILLS :has_ingredient BrownSugar]
[FILLS :has_ingredient Cinnamon]]

BeefStew → [AND MainDish
[FILLS :is_prepared_for 140]
[FILLS :has_ingredient BeefSteak]
[FILLS :has_ingredient BlackPepper]
[FILLS :has_ingredient Carrot]
[FILLS :has_ingredient Onion]
[FILLS :has_ingredient Potato]
[FILLS :has_ingredient VegetableOil]
[FILLS :has_ingredient Water]]

BaconWithEggs → [AND MainDish
[FILLS :is_prepared_for 15]
[FILLS :has_ingredient Bacon]
[FILLS :has_ingredient ChickenEgg]
[FILLS :has_ingredient VegetableOil]]

ChickenFilletWithVegetablles → [AND MainDish
[FILLS :is_prepared_for 15]
[FILLS :has_ingredient ChickenFillet]
[FILLS :has_ingredient Pepper]
[FILLS :has_ingredient Zucchini]
[FILLS :has_ingredient Onion]
[FILLS :has_ingredient Broccoli]
[FILLS :has_ingredient Salt]
[FILLS :has_ingredient BlackPepper]
[FILLS :has_ingredient VegetableOil]]

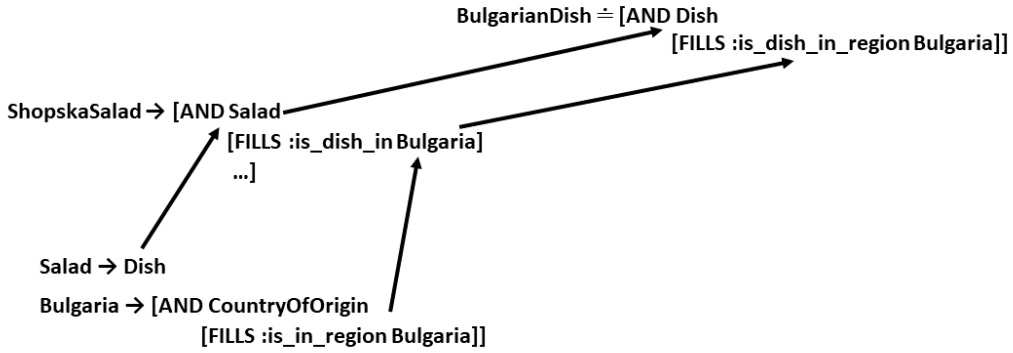
Sushi → [AND MainDish
[FILLS :is_prepared_for 60]
[FILLS :is_dish_in Japan]
[FILLS :has_ingredient Rice]
[FILLS :has_ingredient Avocado]
[FILLS :has_ingredient Salmon]]

ShopskaSalad → [AND Salad
[FILLS :is_prepared_for 20]
[FILLS :is_dish_in Bulgaria]
[FILLS :has_ingredient Cucumber]
[FILLS :has_ingredient Tomato]
[FILLS :has_ingredient Pepper]
[FILLS :has_ingredient Cheese]
[FILLS :has_ingredient Onion]]

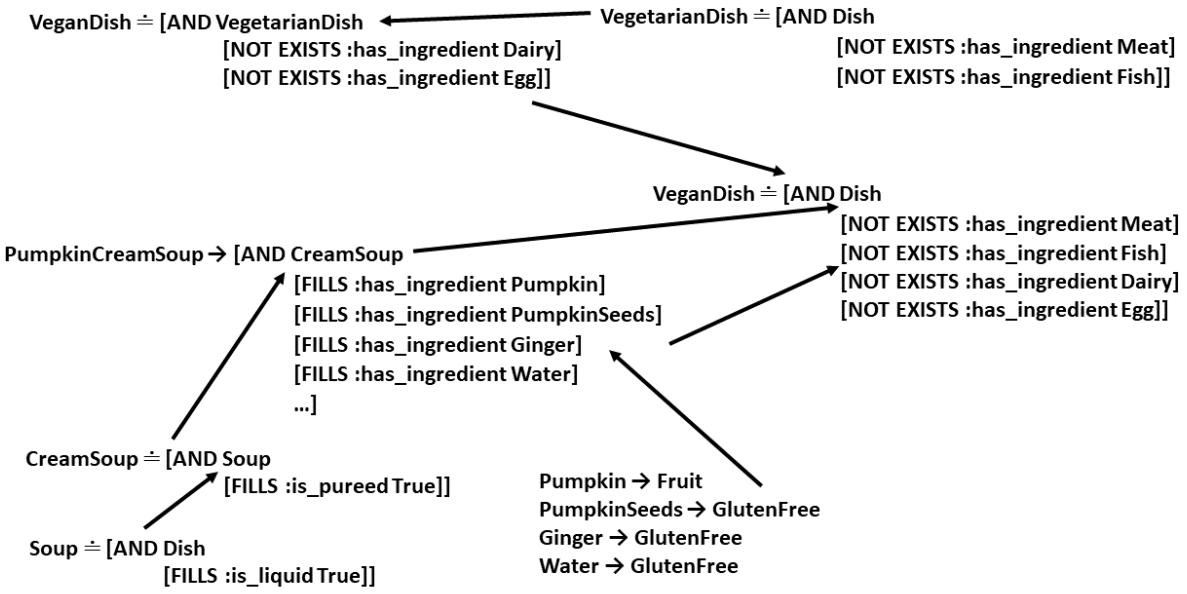
PumpkinCreamSoup → [AND CreamSoup
[FILLS :is_prepared_for 60]
[FILLS :has_ingredient Pumpkin]
[FILLS :has_ingredient PumpkinSeeds]
[FILLS :has_ingredient Ginger]
[FILLS :has_ingredient Water]]

3. Примери за извършване на логически извод

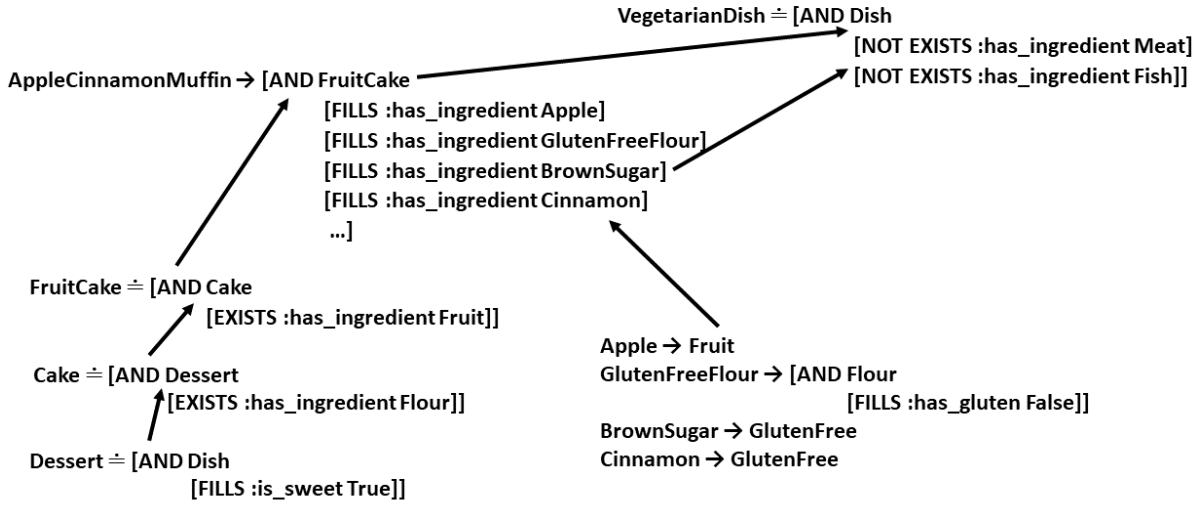
- **KB|= (ShopskaSalad → BulgarianDish)**



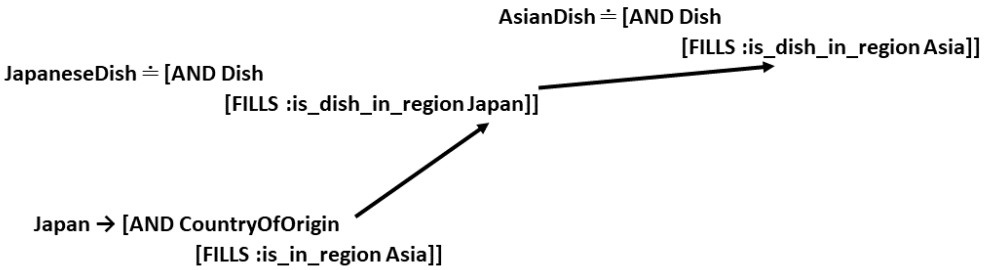
- **KB|= (PumpkinCreamSoup → VeganDish)**



- **KB|= (AppleCinnamonMuffin → VegetarianDish)**

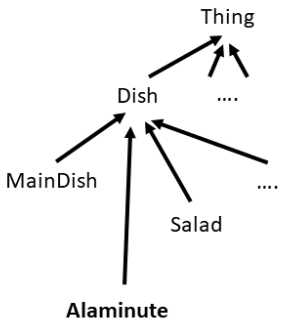


- **KB|= (JapaneseDish ⊑ AsianDish)**

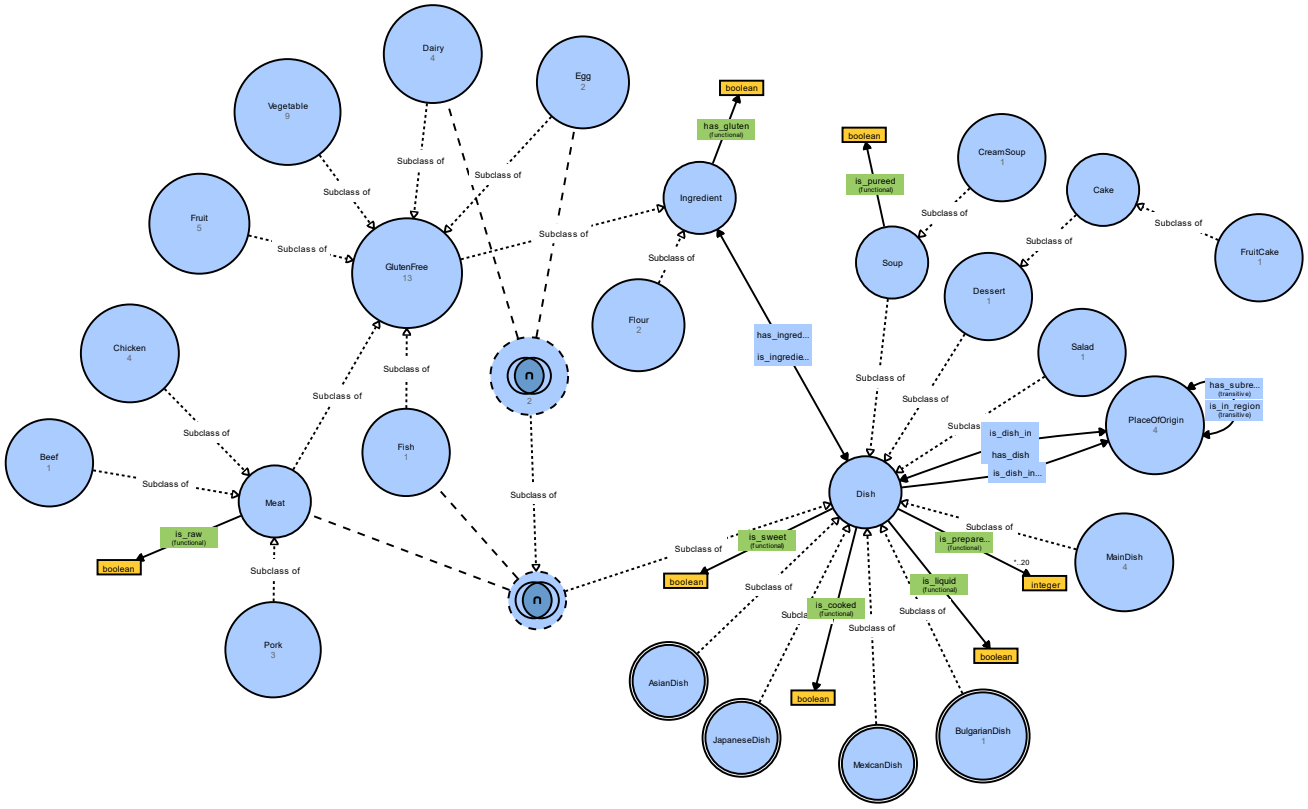


4. Извършване на класификация

Alaminute ≐ [AND Dish
[FILLS :is_cooked True]
[xs:maxInclusive :is_prepared_for 20]]



5. Схема на онтологията



За по-голяма версия вж. файла **dish_ontology.svg**

6. Бъдещо развитие

- Добавяне на още екземпляри към онтологията, за да се обогати знанието за храните.
- Разширяване на онтологията с още концепти и свойства с цел по-добро описание на предметната област.
- Сливане на онтологията с други онтологии, например такава за напитки, тъй като структурата на онтология за напитки би била подобна.
- Публикуване на кода на онтологията онлайн с цел създаване на проект с отворен код, който може да се ползва и допълва от други разработчици, както и от любители на храните.

7. Използвани технологии

- Проектът е имплементиран чрез Python и Owlready2.
- За визуализация на схемата на онтологията е използван онлайн инструментът WebVOWL (http://vowl.visualdataweb.org/webvowl.html).

8. Библиография

- Онтология за храни: https://foodkg.github.io/whattomake.html
- Документация на Owlready2: https://owlready2.readthedocs.io/en/v0.36/intro.html
- Knowledge Representation and Reasoning, Ronald J. Brachman and Hector J. Levesque