Icy: Онтология за Сладоледи

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Курсов проект по
Представяне и моделиране на знания

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Съдържание

Цел

Онтологията icy представя различните концепции и обекти в областта на сладоледите - видове, вкусове и съставки. Тя може да се прилага в различни контексти, включително създаване на функции за търсене на сладоледи в уеб сайт, или мобилно приложение, свързано със сладоледи, както и разработване на препоръчващи системи.

Йерархията е организирана в два аспекта - на концепти, които представляват реални обекти (т.нар. *DomainPartition*) и концепти, които представляват нива на сладост (т.нар. *ValuePartition*). По същество това е имплементация на широко използван шаблон за проектиране на онтологии (*design patten*) дискутиран в [2].

Елементи на онтологията

Концепти

Следващата таблица показва различните концепти в icy, използвайки синтаксиса на *DL*.

Концепти

DomainThing $\sqsubseteq$ Thing

Country $\doteq$ [AND DomainThing
        [ONE-OF Argentina Australia China Greece India
        Indonesia Italy New_Zeland Philippines Spain Turkey
        United_Kingdom United_States Iran]

Food $\sqsubseteq$ DomainThing

IceCream $\sqsubseteq$ [AND Food
        [EXISTS 1 :HasBase]
        [EXISTS 1 :HasTopping]
        [ALL :HasBase IceCreamBase]]

Argentinian $\doteq$ [AND IceCream

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[ALL :HasBase [SOME-FROM Egg Sugar WholeMilk]]
[ALL :HasTopping NaturalToppings]
[FILLS :HasCountryOfOrigin Argentina]]

Italian $\doteq$ [AND IceCream
[ALL :HasBase [SOME-FROM Egg Sugar WholeMilk]]
[ALL :HasTopping NaturalToppings]
[FILLS :HasCountryOfOrigin Italy]]

NamedIceCream $\sqsubseteq$ IceCream

BastaniSonnati $\sqsubseteq$ [AND NamedIceCream
[ALL :HasBase [SOME-FROM Cream Sugar]]
[ALL :HasTopping [SOME-FROM NutTopping RoseWater]]
[FILLS :HasCountryOfOrigin Iran]]

ClottedCreamIceCream $\sqsubseteq$ [AND NamedIceCream
[ALL :HasBase [SOME-FROM Cream Egg Sugar WholeMilk]]
[FILLS :HasCountryOfOrigin United_Kingdom]]

Dondurma $\sqsubseteq$ [AND NamedIceCream
[ALL :HasBase [SOME-OF Sugar WholeMilk]]
[ALL :HasTopping [SOME-OF Pistachios Salep Vanilla]]
[FILLS :HasCountryOfOrigin Turkey]]

Erdbeereis $\sqsubseteq$ [AND NamedIceCream
[ALL :HasBase Cream]
[ALL :HasTopping [SOME-OF Chocolate Pistachios Vanilla]]
[FILLS :HasCountryOfOrigin Australia]]

EsKrim $\sqsubseteq$ [AND NamedIceCream
[ALL :HasBase [SOME-OF Sugar]]
[ALL :HasTopping [SOME-OF Avocado CoconutMilk Durian PandanusLeaves]]
[FILLS :HasCountryOfOrigin Indonesia]]

GlykoKaimaki $\sqsubseteq$ [AND NamedIceCream
[ALL :HasBase [SOME-OF Cream Salep Sugar WholeMilk]]
[ALL :HasTopping [SOME-OF Mastic]]

          [FILLS :HasCountryOfOrigin Greece]]

HaloHalo ⊑ [AND NamedIceCream
          [ALL :HasBase WholeMilk]
          [ALL :HasTopping FruitTopping]
          [FILLS :HasCountryOfOrigin Philippines]]

HeladoDeTurron ⊑ [AND NamedIceCream
          [ALL :HasBase [SOME-OF Cream Egg Sugar]]
          [FILLS :HasCountryOfOrigin Spain]]

Kulfi ⊑ [AND NamedIceCream
          [ALL :HasBase [SOME-OF Cream WholeMilk]]
          [ALL :HasTopping Pistachios]
          [FILLS :HasCountryOfOrigin India]]

VanillaIceCream ⊑ [AND NamedIceCream
          [ALL :HasBase [SOME-OF Cream Sugar]]
          [ALL :HasTopping Vanilla]
          [FILLS :HasCountryOfOrigin Spain]]

Gelato ⊑ [AND NamedIceCream [ALL :HasBase WholeMilk]
          [ALL :HasTopping Mango]
          [FILLS :HasCountryOfOrigin Italy]]

Gelato ⊑ [AND NamedIceCream [ALL :HasBase WholeMilk]
          [ALL :HasTopping Mango]
          [FILLS :HasCountryOfOrigin Italy]]

Helado ⊑ [AND NamedIceCream [ALL :HasBase Egg]
          [ALL :HasTopping Mango]
          [FILLS :HasCountryOfOrigin Argentina]]

Mochi ⊑ [AND NamedIceCream [ALL :HasBase Egg]
          [ALL :HasTopping [SOME-FROM BlackSesame Vanilla]]
          [FILLS :HasCountryOfOrigin China]]

Magnum ⊑ [AND NamedIceCream [ALL :HasBase Cream]
          [ALL :HasBase Sugar]
          [ALL :HasBase Water]

[ALL :HasTopping Chocolate]
[FILLS :HasCountryOfOrigin United_States]]

PopularIceCream $\doteq$ [AND IceCream
[ALL :HasTopping [SOME-FROM Chocolate Coffee Mango Strawberry Vanilla]]]

HighCalorieIceCream $\doteq$ [AND IceCream
[ALL :HasCalorificContentValue $>=$150]]
LowCalorieIceCream $\doteq$ [AND IceCream
[ALL :HasCalorificContentValue $<$150]]

NonTraditionalIceCream $\doteq$ [AND IceCream
[ALL :IsTraditional false]]
TraditionalIceCream $\doteq$ [AND IceCream
[ALL :IsTraditional true]]

Chinese $\doteq$ [AND PopularIceCream
[ALL :HasTopping [SOME-FROM BlackSesame RedBean]]
[FILLS :HasCountryOfOrigin China]]

IceCreamBase $\sqsubseteq$ Food
Cream $\sqsubseteq$ IceCreamBase
Egg $\sqsubseteq$ IceCreamBase
Noodle $\sqsubseteq$ IceCreamBase
Salep $\sqsubseteq$ IceCreamBase
Sugar $\sqsubseteq$ IceCreamBase
Water $\sqsubseteq$ IceCreamBase
WholeMilk $\sqsubseteq$ IceCreamBase

IceCreamTopping $\sqsubseteq$ Food

BeanTopping $\sqsubseteq$ IceCreamTopping
Coffee $\sqsubseteq$ [AND BeanTopping [ALL :HasSweetness None]]
Mastic $\sqsubseteq$ [AND BeanTopping [ALL :HasSweetness None]]
MungBean $\sqsubseteq$ [AND BeanTopping [ALL :HasSweetness None]]

RedBean ⊑ [AND BeanTopping [ALL :HasSweetness None]]

FruitTopping ⊑ IceCreamTopping
Apple ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]
Avocado ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]
Banana ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]
Durian ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]
Jackfruit ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]
Lemon ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]
Mango ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]
Strawberry ⊑ [AND FruitTopping [ALL :HasSweetness Medium]]

HerbSpiceTopping ⊑ IceCreamTopping
BlackSesame ⊑ [AND HerbSpiceTopping [ALL :HasSweetness None]]
PandanusLeaves ⊑ [AND HerbSpiceTopping [ALL :HasSweetness None]]
Vanilla ⊑ [AND HerbSpiceTopping [ALL :HasSweetness Low]]

LiquidTopping ⊑ IceCreamTopping
Chocolate ⊑ [AND LiquidTopping [ALL :HasSweetness High]]
CoconutMilk ⊑ [AND LiquidTopping [ALL :HasSweetness Medium]]
PalmSugar ⊑ [AND LiquidTopping [ALL :HasSweetness High]]
RoseWater ⊑ [AND LiquidTopping [ALL :HasSweetness Medium]]
SugarSyrup ⊑ [AND LiquidTopping [ALL :HasSweetness High]]

NutTopping ⊑ IceCreamTopping
Pistachios ⊑ [AND NutTopping [ALL :HasSweetness None]]

HardToppings ≐ [AND IceCreamTopping
[SOME-FROM   BeanTopping   HerbSpiceTopping
NutTopping]]
NaturalToppings ≐ [AND IceCreamTopping [NOT LiquidTopping]]
NonSweetToppings ≐ [AND IceCreamTopping [NOT SweetToppings]]
SweetToppings ≐ [AND IceCreamTopping
[ALL :HasSweetness [SOME-FROM High Medium]]]

ValuePartition ⊑ Thing

Концепти

Sweetness $\doteq$ [AND ValuePartition [SOME-FROM High Medium Low None]]
High $\sqsubseteq$ Sweetness
Low $\sqsubseteq$ Sweetness
Medium $\sqsubseteq$ Sweetness
None $\sqsubseteq$ Sweetness

Уточнения за горната таблица:

- [NOT d_1 d_2 ... d_k] описва тези индивиди, които не са представители на всички d_i;

- [SOME-OF d_1 d_2 ... d_k] описва тези индивиди, които са представители на някои d_i, с възможност за припокриване. Това е аналогът на ограничението *someValuesFrom*, използвано в OWL;

- I[[AND DomainThing ValuePartition]] = $\emptyset$;

- I[[AND IceCream IceCreamTopping IceCreamBase]] = $\emptyset$;

- I[[AND BeanTopping NutTopping FruitTopping LiquidTopping HerbSpiceTopping]] = $\emptyset$;

- I[[AND Cream Egg Noodle WholeMilk Salep Sugar Water]] = $\emptyset$;

- I[[AND Coffee RedBean Mastic MungBean]] = $\emptyset$;

- I[[AND Avocado Lemon Durian Strawberry Mango Banana Jackfruit Apple]] = $\emptyset$;

- I[[AND Vanilla BlackSesame PandanusLeaves]] = $\emptyset$;

- I[[AND SugarSyrup CoconutMilk RoseWater Chocolate PalmSugar]] = $\emptyset$.

Свойства

Следващите таблици показват наличните свойства. Представени са както релации между индивидуални обекти (т.нар. *Object properties*), така и релации между индивидуални обекти и данни от определени типове (т.нар. *Data properties*).

Свойства на обектите

Домейн	Свойство	Рейндж	Характеристика
Food	hasCountryOf Origin	Country	-
Food	hasIngredient	Food	*transitive*
Food	hasBase	IceCreamBase	-
Food	hasTopping	IceCream Topping	*inverse functional*
IceCreamTopping	hasSweetness	Sweetness	*functional*
Food	isIngredientOf	Food	*inverseOf* hasIngredient
IceCreamBase	isBaseOf	Food	*inverseOf* hasBase
IceCreamTopping	isToppingOf	Food	*inverseOf* hasTopping

Свойства на данните

Домейн	Свойство	Рейндж	Характеристика
IceCream	hasCalorific ContentValue	xsd:integer	*functional*
IceCream	isTraditional	xsd:bool	*functional*

Индивиди

Индивиди
Argentina → Country
Australia → Country
China → Country
Greece → Country
India → Country
Indonesia → Country
Iran → Country
Italy → Country
New_Zeland → Country
Philippines → Country
Spain → Country
Turkey → Country
United_Kingdom → Country
United_States → Country

ExampleBastaniSonnati → [AND BastaniSonnati
　　　　　[FILLS :HasCalorificContentValue 159]
　　　　　[FILLS :IsTraditional true]]
ExampleClottedCreamIceCream → [AND ClottedCreamIceCream
　　　　　[FILLS :HasCalorificContentValue 200]
　　　　　[FILLS :IsTraditional true]]
ExampleDondurma → [AND Dondurma
　　　　　[FILLS :HasCalorificContentValue 149]
　　　　　[FILLS :IsTraditional true]]
ExampleErdbeereis → [AND Erdbeereis
　　　　　[FILLS :HasCalorificContentValue 320]
　　　　　[FILLS :IsTraditional true]]
ExampleEsKrim → [AND EsKrim
　　　　　[FILLS :HasCalorificContentValue 42]
　　　　　[FILLS :IsTraditional true]]
ExampleGelato → [AND Gelato
　　　　　[FILLS :HasCalorificContentValue 120]
　　　　　[FILLS :IsTraditional true]]
ExampleGlykoKaimaki → [AND GlykoKaimaki

Индивиди
[FILLS :HasCalorificContentValue 310]
[FILLS :IsTraditional true]]
ExampleHaloHalo → [AND HaloHalo
[FILLS :HasCalorificContentValue 33]
[FILLS :IsTraditional false]]
ExampleHelado → [AND Helado
[FILLS :HasCalorificContentValue 159]
[FILLS :IsTraditional true]]
ExampleHeladoDeTurron → [AND HeladoDeTurron
[FILLS :HasCalorificContentValue 169]
[FILLS :IsTraditional true]]
ExampleKulfi → [AND Kulfi
[FILLS :HasCalorificContentValue 70]
[FILLS :IsTraditional true]]
ExampleMagnum → [AND Magnum
[FILLS :HasCalorificContentValue 200]
[FILLS :IsTraditional false]]
ExampleMochi → [AND Mochi
[FILLS :HasCalorificContentValue 96]
[FILLS :IsTraditional true]]
ExampleVanillaIceCream → [AND VanillaIceCream
[FILLS :HasCalorificContentValue 350]
[FILLS :IsTraditional false]]

Примери за извършване на логически извод

Пример 1

KB |= (ExampleMagnum → HighCalorieIceCream)

ExampleMagnum *Type* **Magnum**

        Magnum *SubClassOf* **NamedIceCream**

                NamedIceCream *SubClassOf* **IceCream**

ExampleMagnum *hasCalorificContentValue* 200

IceCream and ($hasCalorificContentValue >= 150$) *SubClassOf* **HighCalorieIceCream**

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Пример 2

KB |= (ExampleHaloHalo → NonTraditionalIceCream)

ExampleHaloHalo *Type* **HaloHalo**
     HaloHalo *SubClassOf* **NamedIceCream**
         NamedIceCream *SubClassOf* **IceCream**
ExampleHaloHalo *isTraditional false*
IceCream and (*isTraditional* value *false*) *SubClassOf* **NonTraditionalIceCream**

Пример 3

KB |= (Mochi ⊑ Chinese)

Mochi *SubClassOf* **NamedIceCream**
     NamedIceCream *SubClassOf* **IceCream**
Mochi *SubClassOf* hasTopping some **BlackSesame**
Mochi *SubClassOf* hasTopping some **Vanilla**
Mochi *SubClassOf* hasCountryOfOrigin value **China**
PopularIceCream *EquivalentTo* **IceCream** and (hasTopping some (Chocolate or Coffee or Mango or Strawberry or Vanilla))
Chinese *EquivalentTo* **PopularIceCream** and (hasTopping some (BlackSesame or RedBean)) and (hasCountryOfOrigin value China)

Извършване на класификация

Заявки към базата от знание

DL заявки

TODO

SPARQL заявки

TODO

Схема на онтологията

TODO

Бъдещо развитие

TODO

Използвани технологии

TODO

Списък на фигурите

Източници

1. Wikipedia Article on Ice Cream
2. Matthew Horridge. A Practical Guide To Building OWL Ontologies Using Protégé 4 and CO-ODE Tools Edition 1.3