PackageBuilder: From Tuples to Packages

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http://packagebuilder.cs.umass.edu

**Motivation**

I want a meal plan for the day:
- No more than 5g of saturated fat on each meal
- 3 to 6 meals per day
- At least 140g of protein in total
- Minimal preparation time!

**Package Builder**

PackageBuilder is a system that extends query engines to support package generation.

A package is a collection of tuples with certain global properties defined on the collection as a whole.

**Language Specification: PaQL**

```
SELECT PACKAGE(R) AS P
FROM Recipes R
WHERE R.saturatedfat <= 5
AND count(P.*) BETWEEN 3 and 6
AND sum(P.protein) >= 140
MINIMIZE sum(P.totaltime)
```

**Interactive Exploration**

Users can easily modify constraints. An auto-suggest feature helps with syntax.

**Adaptive Exploration**

The current package's position in the result space is highlighted.

Only packages found so far are visualized. Running indicates incomplete result space.

**Query Evaluation**

**Brute Force**

**Random Walk**

**Hill Climbing**

**A* Search**

**MIP Solver**

**Approximated Local Search**

- By transforming the query into a linear program:
  - \( \sum_{i=1}^{n} x_i \geq 3 \)
  - \( \sum_{i=1}^{n} x_i \cdot y_{\text{protein}} \geq 140 \)

- By adding, removing or replacing tuples, e.g.:

```
SELECT P.recipe, C.recipe
FROM P, CORE-table AS C
WHERE 150 - P.protein + C.protein >= 140
```