## Rotterdam, The Netherlands July $\mathbf{2 8}^{\text {th }}, 2010$



## An Efficient Approach to Solving Complex Market Research Problems

Presented By:
Charles M. Fayle
The Institute for Perception charles.m.fayle@ifpress.com +001804675 2980

## !|An Example of Maximum Coverage

> Three advertising concepts for juice drink product > Ten consumers polled

| Consumer | Beach | Park | School |
| :---: | :---: | :---: | :---: |
| A | x |  |  |
| B | x |  |  |
| C |  | x | x |
| D | x |  |  |
| E |  |  | x |
| F |  | x |  |
| G |  |  |  |
| H |  | x | x |
| I |  |  | x |
| J | x | x |  |

- Goal: Find two concepts that reach most consumers



## $\circ$ 0 0 0 0 <br> Maximum Coverage

> Maximum coverage problems are widespread
> Advertizing optimization

* Maximize number of consumers reached
* Maximize number of households reached
> Menu optimization
* Maximize number of interested consumers
* Maximize number of ingredients used
> Portfolio optimization
* Maximize first choices among consumers
* Maximize top box scores
> Any TURF application is a maximum coverage problem


## $\circ$ 0 0 0 0 <br> Total Unduplicated Reach and Frequency

> TURF (Total Unduplicated Reach and Frequency) is a technique introduced by Miaoulis, Parsons and Free (1990)

* Venn Diagram based approach

* Maximizes total coverage of combinations
* Originally used to estimate reach of advertising
* Has been used extensively to maximize purchase interest


## 0 0 0 0 0 <br> TURF - Advantages and Disadvantages

> Advantages:

* Flexible technique with many applications
* Easy to understand and explain
* Clear guidance
* Visualization possible for small number of concepts


## > Disadvantages

* Visualization not possible for larger numbers of concepts
* Huge number of combinations when number of concepts is large
- 5 concepts out of $100=75,287,520$ combinations
- 10 concepts out of $100=17,310,309,456,440$ combinations
* Approximate solutions exist for large problems but generally are not exact

\section*{| $\circ$ |
| :--- |
|  |
| $\circ$ |
| 0 |
| 0 | <br> Maximum Coverage}

> Any TURF application is a maximum coverage problem

* Want combination of concepts or products with most consumers
* Number of concepts or products in combination is fixed
> Maximal coverage problems can be approached using advanced algorithms
> Exact and approximate algorithms exist
. Problem is NP-Hard
* Greedy algorithm is frequently reasonable but does not give exact answers, plus examples exist which illustrate possible results that are decidedly inferior
> Ennis and Fayle (to be published shortly) is first efficient exact algorithm


## $\circ$ $\circ$ 0 0 0 <br> Maximum Coverage Solution

> Idea of solution:

* Too many combinations to directly evaluate
* Need to avoid as many combinations as possible by using exclusion criteria
* We proceed through a series of incremental sub problem solution steps
* Each step executes recursively and uses the results of previous steps to limit the search
> Example:
* Suppose there are 7 concepts and 100 consumers
* Want 5 concepts that appeal to greatest number of consumers


# 0 0 0 0 0 

## Maximum Coverage Algorithm

Best 1 of 1

| Best 1 of 2 | Best 1 of 3 | Best 1 of 4 | Best 1 of 5 | Best 1 of 6 | Best 1 of 7 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| F i \% is |  |  |  |  |  |
| Best 2 of 2 | Best 2 of 3 | Best 2 of 4 | Best 2 of 5 | Best 2 of 6 | Best 2 of 7 |
|  | § F F ¢ |  |  |  |  |
|  | Best 3 of 3 | Best 3 of 4 | Best 3 of 5 | Best 3 of 6 | Best 3 of 7 |
|  |  | \% $\%$ |  |  |  |
|  |  | Best 4 of 4 | Best 4 of 5 | Best 4 of 6 | Best 4 of 7 |

- Can find best 10 out of 100 in many practical examples

Best 5 of 6
> Have found best 12 out of 100
(1,050,421,051,106,700 possible combinations)

\section*{| $\circ$ |
| :--- |
|  |
| 0 |
| 0 |
| 0 | <br> Competitive Portfolio Optimization}

> When competitors exist, portfolio optimization is maximal coverage problem
> Want products to work together to maximize market share



| Market Share for $\mathrm{P}_{2}$ and $\mathrm{P}_{3}$ |
| :---: |
| $41.67 \%$ |

## $\circ$ 0 0 0 0 <br> Competitive Portfolio Optimization

> Considerations:

* Infinitely many locations possible for prototypes
* Only finitely many consumers and competitors
* A fine enough grid will contain locations that give optimal results


\section*{| $\circ$ |
| :--- |
|  |
| 0 |
| 0 |
| 0 | <br> Competitive Portfolio Optimization}

> For each grid point determine which consumers are reached in the presence of competition

> Use maximum coverage tools to find combination maximizing market share

## !| Portfolio Optimization Example

> LSA results for 9 cookie brands and 250 consumers:


## $\circ$ 0 0 0 <br> Portfolio Optimization Example

> We seek a portfolio that optimizes market share in the presence of 4 competitors:

| Happy Elf 1 | Sunny Lemon |
| :---: | :---: |
| Sugar Farms 2 | Chocolate Island 2 |

> We find the combination of 3 locations on LSA map that reaches the greatest number of consumers
> We cover the space with a $25 \times 25$ grid and use maximal coverage tools to find optima
> We use scales to predict profiles for the optima and provide guidance to product development

1
Happy Elf 1 Frototype 2
Happy Elf 2

Sugar Farms 2
2

\section*{| $\circ$ |
| :--- |
|  |
| 0 |
| $\circ$ |
| $\circ$ | <br> Summary}

> Maximal coverage problems appear in many forms

* TURF-type problems
* Portfolio optimization
> Solutions to large problems approximate until now
> New algorithm avoids poor combinations to find solution
> Algorithm allows for portfolio optimization in presence of competition
> Large TURF-type problems can now be solved exactly


## Rotterdam, The Netherlands July $\mathbf{2 8}^{\text {th }}, 2010$



## An Efficient Approach to Solving Complex Market Research Problems

Presented By:
Charles M. Fayle
The Institute for Perception charles.m.fayle@ifpress.com +001804675 2980

