

Combining Loan Requests and Investment Offers in Peer-To-Peer Lending

Luís Martinho

IA4TEB Workshop – ECAI 2010

August 17th 2010



Preview

- Peer-to-Peer Lending
- Problem Formulation
- Related Work
- Optimization Framework
- Experimental Results
- Discussion and Conclusions
- Future Work



Peer-to-Peer Lending

- History: Common Barns, *Montepios* and Friendly Societies
- Web 2.0: Zopa (UK, pooled) and Prosper (USA, direct)
- Market Views (USA, 2007: \$647M - 2010: \$5.8Bn)
- Roda Project (PT, pooled + direct)



Matching Requests with Offers

- **Loan Requests:**
 - Desired Amount
 - Maximum requested Interest Rate
- **Investment Offers:**
 - Available Amount
 - Minimum offered Interest Rate
- **Deals** (*Loan-Investment tuples*)



Problem Formulation

- Parameters:
 - N lenders (i), M borrowers (j)
 - Rates: $Rmin_i, Rmax_j$
 - Amounts: $Amax_i, Amin_i, Amax_j, Amin_j$
- Decision Variables:
 - Combination Rates: r_{ij}
 - Combination Amounts: a_{ij}
- Problem as (S, f)



Problem Formulation (cont.)

- Problem Space Constraints:

- C1:
$$\frac{\sum_{i=1}^N a_{ij} * r_{ij}}{N} \leq Rmax_j \forall j \in \{1, \dots, M\}$$

- C2:
$$\frac{\sum_{j=1}^M a_{ij} * r_{ij}}{M} \geq Rmin_i \forall i \in \{1, \dots, N\}$$

- C3:
$$Amin_i \leq \sum_{j=1}^M a_{ij} \leq Amax_i \forall i \in \{1, \dots, N\}$$

- C4:
$$Amin_j \leq \sum_{i=1}^N a_{ij} \leq Amax_j \forall j \in \{1, \dots, M\}$$



Problem Formulation (concl.)

- Tight Margin Utility:
 - Member Profit
 - Fairness
 - Demands Satisfaction (Volume)

$$(k_{MemberMargin} * MemberMargin) * (k_{Tightness} * Tightness) * (k_{FulfillmentRate} * FulfillmentRate)$$



Optimization Metaheuristics

- Optimization Metaheuristics:
 - Trajectory Based (*Pure Random Search, Hill-Climbing, Simulated Annealing, Tabu Search*)
 - Population Based (*Evolutionary Computation, Particle Swarm Optimization*)
- Constraint Programming:
 - Constraint Satisfaction Problems
 - Constraint Programming Libraries

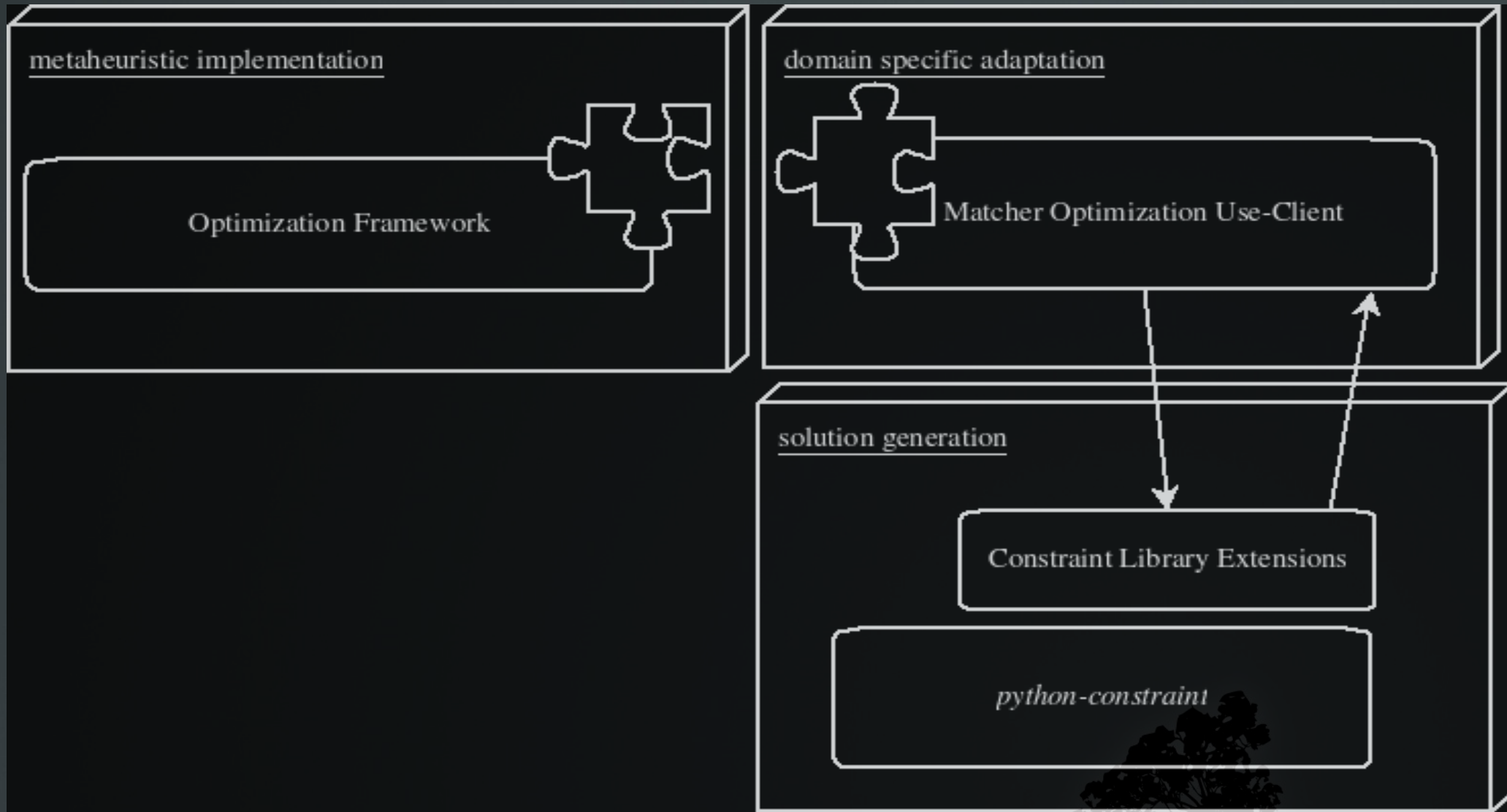


Optimization Framework

- Solution Generation
- Optimization Framework
- Matcher Use-Client



Optimization Framework (cont.)



Experimental Setups

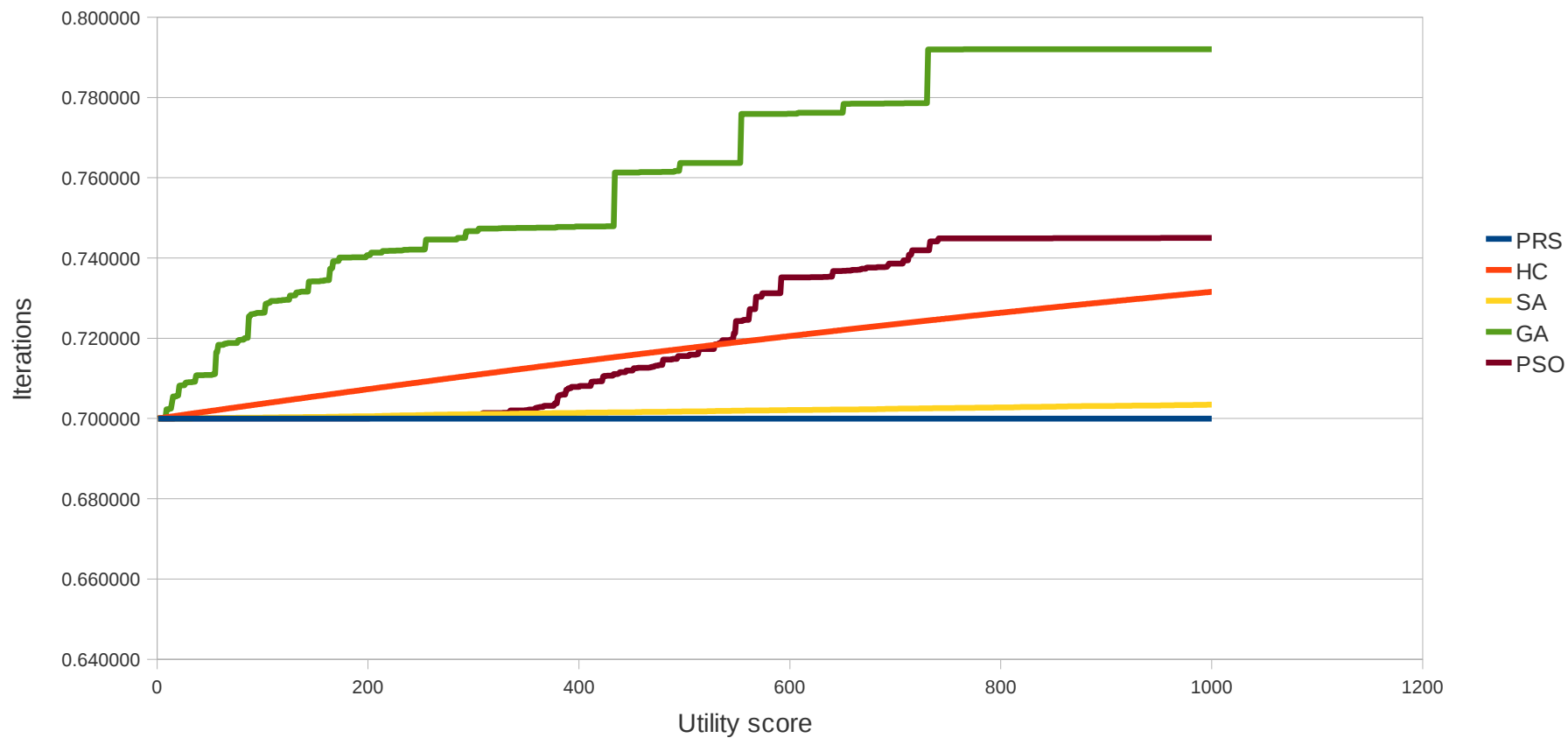
- Parameters to evaluate:
 - **Most efficient metaheuristic**
 - Best configuration for each algorithm
 - Most business relevant utility function (out of scope)
- Experimental Setup Templates:
 - *Tight: 5%-20% com $\delta=1\%$*
 - *Loose: 5%-20% com $\delta=5\%$*
- Manual Tuning for each algorithm



Experimental Results - Tight

Metaheuristic Performance

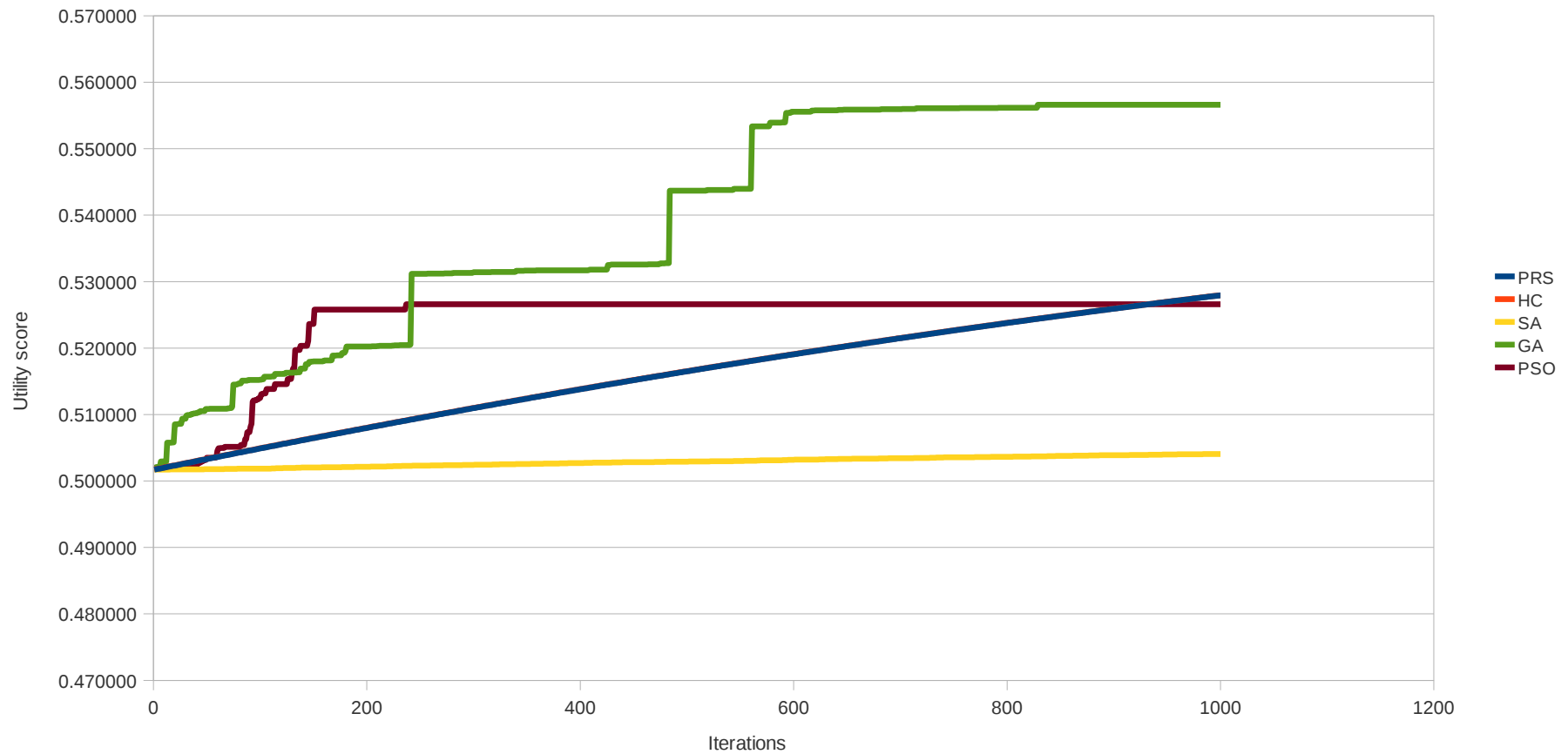
Tight Market



Experimental Results - Loose

Metaheuristic Performance

Loose Market



Conclusions

- Successful matches achieved:
 - Set generation (despite small)
 - Parameter tuning
 - Metaheuristic comparison
- Yielded reusable optimization solution
- Needs validation of the utility function (out of scope)



Future Work

- Utility Functions:
 - Efficient Markets, Game Theory
- Distributed Optimization:
 - Cloud-ready, Map Reduce
- Multi-Agent System:
 - Distributed and Cooperative (more P2P-like)
- Collaborative Rating:
 - Trust Management in P2P



Thank You

- luis.martinho@fe.up.pt
- www.roda.cc
- luis@roda.cc

roda.cc
invista nas pessoas

Seja bem vindo à mais recente comunidade de investimentos de Portugal.

investir | pedir | ajuda

registe-se! | login ▶

INVISTA O SEU DINHEIRO emprestando

Na Roda, Investidores podem emprestar o seu dinheiro a pessoas que precisam. Sem Intermediários (bancos), de pessoas para pessoas.

O Investimento, que pode começar a partir de 10€, é feito de forma segura e confidencial, sendo possível definir: taxa, prazo e a quem será emprestado. Tudo isto de maneira tão simples quanto um clique.

Aqui existem pessoas dispostas a pagar pelo seu dinheiro!

[Saiba como emprestar!](#)

OU PEÇA DINHEIRO emprestado

Deixe de adiar os seus projectos. Adquirá empréstimos de outros membros da Roda, definindo a taxa e o prazo em que pode pagar este dinheiro.

Não há Intermediários neste processo. Somente o Creditado e o Investidor. Assim é possível encontrar taxas menores do que as praticadas pelo mercado. Na Roda encontrará a flexibilidade que procura.

Aqui existem pessoas dispostas a investir em si.

[Saiba como pedir emprestado!](#)

REGISTE-SE AGORA! **AVISE OS SEUS AMIGOS!**

início | sobre a Roda | investir | pedir | ajuda | sobre o crédito colaborativo | fale connosco

beta feedback | encontrou algum bug? | envie sugestões e críticas!