Artificial Intelligence for deterministic 2 players games with UCT

Pierre Gueth

1er octobre 2013

Motivation

- Artificial intelligence
- PG camera
- Discrepancies between planned and actual configurations

Aims

- Prediction of perturbation amplitude
- Study of correlation between PG profiles and perturbation components
 - · Distal falloff position
 - Maximum correlation between profiles

Context

Granularity

- Whole treatment fraction ($\sim 10^{10}$ protons for 2 Gy)
- Energy layer (constant energy, $\sim 10^9$ protons for 2 Gy)
- Spot by spot monitoring (~ 10⁷ protons for 2 Gy)

Monitoring device

- Vertex imaging (inline, only for heavy projectiles)
- Prompt gamma camera (inline, proton and heavy projectiles)

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PG monitoring technology

Compton camera

- Compton interaction in scatter detector
- Emission position from line-cone intersection

Knife edge

- Count hits of PG passing through a knife edge slit
- Easy geometrical reconstruction

Multiple slits

- Count hits of PG passing through slits
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Types of perturbation

- Patient position
- Patient orientation
- Stoichiometric calibration of TPS
- Tumor regression / anatomical change
- Internal organ motion

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Classifier training

 Find measure threshold by maximizing associated specificity and sensitivity (MASS)

$$\begin{aligned} \text{specificity} &= \frac{\text{TN}}{\text{TN} + \text{FP}} \\ \text{sensitivity} &= \frac{\text{TP}}{\text{TP} + \text{FN}} \\ \\ \text{MASS} &= \max_{MT} \sqrt{\text{specificity}^2 + \text{sensitivity}^2} \end{aligned}$$

Upper-left most point in ROC curves

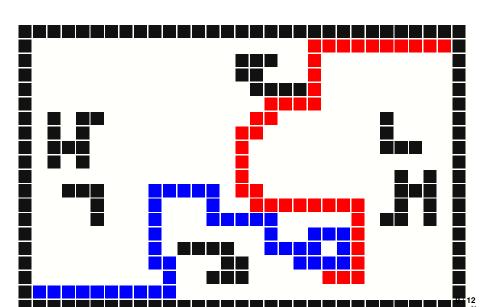
Classifier training

C++ implementation

```
class Board {
public:
    virtual ~Board() =0;

    virtual Board *deepcopy() const =0;
    virtual Move *parse_move_string(Token player,const char *string) const =0;
    virtual void print() const =0;
    virtual bool is_move_valid(const Move &move) const =0;
    virtual bool is_move_valid(const Move &move) const =0;
    virtual Moves get_possible_moves(Token player) const =0;
    virtual void play_move(const Move &move) =0;
    virtual bool play_random_move(Token player) =0;
    virtual Token check_for_win() const =0;
    virtual Token play_random_game(Token next_player);
};
```

Google Al Challenge 2010 : Tron



Demonstation Can you beat the IA?

Thanks for your attention

Pierre Gueth

Wide technical and academical knowledge

- Classe préparatoire PT
- ENS Cachan aggrégation physique appliquée / EEA
- Thèse au laboratoire CREATIS (Université Lyon I) Imagerie médicale ultrasonore Estimation de mouvement
- Post doc au Centre Léon Bérard (Lyon)
 Simulation Monte-Carlo Protonthérapie (GATE)
 Imagerie γ-prompt

Numerous computer side project

- Freesiege, Blocks, ...
- UCT
- Autojump, cluster submission tools