▸ STANISLAV SMERDOV, *On the question of consistence of the semantic μ-prediction.*
Mechanics and Mathematics Department, Novosibirsk State University, 2 Pirogova St., Novosibirsk, Russia.
E-mail: `netid@ya.ru`.

First we define a probability on the set of all ground sentences according to [1]. Allow literals (not only atoms) to appear in a classical logic programming structures of rule, fact and query; here probabilities on ground instances are defined as conditional.

$$\mathtt{Rule}^{\mu}_{\mathrm{L}} \rightleftharpoons \{\mathrm{C} \in \mathtt{Rule}_{\mathrm{L}} \mid \textit{ for some ground } \theta \textit{ probability of } \mathrm{C}\theta \textit{ is determined}\};$$
$$\underline{\mu}\,(\mathrm{C}) \rightleftharpoons \inf\left\{\mu\,(\mathrm{C}\theta) \mid \theta \textit{ is a ground substitution and } \mathrm{C}\theta \in \mathtt{Rule}^{\mu}_{\mathrm{L}}\right\}, \textit{ where } \mathrm{C} \in \mathtt{Rule}^{\mu}_{\mathrm{L}}.$$

Binary relation $\mathrm{C}_1 \rhd \mathrm{C}_2$ between $\mathrm{C}_1 = (\mathrm{A}_1 \Leftarrow \mathrm{B}_1, ..., \mathrm{B}_n)$, $\mathrm{C}_2 = (\mathrm{A}_2 \Leftarrow \mathrm{D}_1, ..., \mathrm{D}_m)$ in $\mathtt{Rule}^{\mu}_{\mathrm{L}}$ takes place iff there exist a substitution θ such that $\{\mathrm{B}_1\theta, ..., \mathrm{B}_n\theta\} \subseteq \{\mathrm{D}_1, ..., \mathrm{D}_m\}$, $\mathrm{A}_1\theta = \mathrm{A}_2$ and C_1 is not a variant for C_2; in this case we say "C_1 *is more general than* C_2". Rules from $\mathtt{Rule}^{\mu}_{\mathrm{L}}$ which can't be generalized without decreasing the conditional probability $\underline{\mu}\,(\cdot)$ are called *μ-laws*; denote corresponding set by $\mathtt{GLaw}^{\mu}_{\mathrm{L}}$.

$\mathtt{Data}\,(\mathfrak{B})$ is a set of actual facts for 1-st order model $\mathfrak{B}$. A process of SLD-inference with probability estimations is replaced with *semantic μ-prediction* (or *P-prediction*) from the set of μ-laws which are valid for accessible data. Note: this concept has common features with semantic approach in programming (see [2] for analogies). As a result we obtain *the best prediction μ-law* for every ground literal, if semantic μ-prediction is determined. All necessary definitions are natural extension of those introduced in [3]. For each best rule $\mathrm{C} = \mathrm{A} \Leftarrow \mathrm{B}_1, ..., \mathrm{B}_n$ used in prediction of some H we consider all $\mathrm{C}\theta$ such that θ is a ground substitution, $\{\mathrm{B}_1\theta, ..., \mathrm{B}_n\theta\} \subseteq \mathtt{Data}\,(\mathfrak{B})$, $\mathrm{A}\theta = \mathrm{H}$ and $\{\mathrm{B}_1\theta, ..., \mathrm{B}_n\theta\}$ is μ-concurred (set of literals S is called *μ-concurred* iff $\mu\left(\bigwedge_{\mathrm{A}\in S}\mathrm{A}\right) \neq 0$). Resulted set of described ground instances (over all literals) is denoted by $\mathtt{Prdct}^{\mu,0}_{\mathrm{L}}$.

THEOREM 1. *Let some ground atom* H *be semantically μ-predicted by ground instance* $\mathrm{C}_{pos} \in \mathtt{Prdct}^{\mu,0}_{\mathrm{L}}$ *of the rule* $\mathrm{C}_1 \in \mathtt{GLaw}^{\mu}_{\mathrm{L}}$ $(\mathrm{C}_{pos} = \mathrm{C}_1\theta_{pos})$*, while* $\neg\mathrm{H}$ *— by* C_{neg} $(\mathrm{C}_{neg} = \mathrm{C}_2\theta_{neg})$*. Then the set of atoms from premises of* C_{pos} *and* C_{neg} *is not μ-concurred.*

$$\Gamma_{\mathfrak{B}} = \left\{\mathrm{B}_1 \wedge ... \wedge \mathrm{B}_n \to \mathrm{A} \middle| \mathrm{A} \Leftarrow \mathrm{B}_1 \wedge ... \wedge \mathrm{B}_n \in \mathtt{Prdct}^{\mu,0}_{\mathrm{L}}\right\} \cup \{\mathrm{A} \mid (\mathrm{A} \Leftarrow) \in \mathtt{Data}\,(\mathfrak{B})\}$$

THEOREM 2. *Let* $\mathtt{Data}\,(\mathfrak{B})$ *be μ-concurred. Then minimal theory containing* $\Gamma_{\mathfrak{B}}$ *is logically consistent.*

[1] J.Y. HALPERN, *An Analysis of First-Order Logics of Probability*, ***Artificial Intelligence***, no. 46, 1990, pp. 311-350.

[2] S.S. GONCHAROV, YU.L. ERSHOV, D.I. SVIRIDENKO, *Semantic programming*, ***10th World Congress Information Processing 86*** (Dublin), vol. 10, Amsterdam, 1986, pp. 1093–1100.

[3] E.E. VITYAEV, *The logic of prediction*, ***Mathematical Logic in Asia, Proceedings of the 9th Asian Logic Conference*** (Novosibirsk, Russia), (S.S. Goncharov, R. Downey, H. Ono, editors), World Scientific, Singapore, 2006, pp. 263–276.