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GENERALIZED NET MODELS IN NEUROLOGY (CHRONIC HEADACHE)

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The present study is based on the book [1] and our research [2]. It uses the scheme on p. 10 from [1]. We shall construct the Generalized Net (GN; see [3]) NGN5 (see [2]).

In place l_1 enters a token with an initial characteristic "chronic headache". It activates the GN NGN5 which has the following transitions.

$$Z_1 = \langle \{l_1\}, \{l_2, l_3\}, r_1 \rangle,$$

where

$$r_1 = \begin{array}{c|cc} & l_2 & l_3 \\ \hline l_1 & W_{1,2} & W_{1,3} \end{array}$$

where

$W_{1,2}$ = "the headache is progressive",

$W_{1,3}$ = "the headache is recurrent".

If the token enters place l_2, then it obtains a characteristic "data for other neurological symptoms"; if the token enters place l_3, then it does not obtain a characteristic.

$$Z_2 = \langle \{l_2\}, \{l_4, l_5\}, r_2 \rangle,$$

where

$$r_2 = \begin{array}{c|cc} & l_4 & l_5 \\ \hline l_2 & W_{2,4} & W_{2,5} \end{array}$$

where

$W_{2,4}$ = "there are data for other neurological symptoms of the patient",

$W_{2,5} = \neg W_{2,4}$.

If the token enters place l_4, then it obtains a characteristic "check for sinus disease"; if the token enters place l_5, then it obtains a characteristic "neurological examination and evaluation are necessary".

$$Z_3 = \langle \{l_3\}, \{l_6, l_7\}, r_3 \rangle,$$

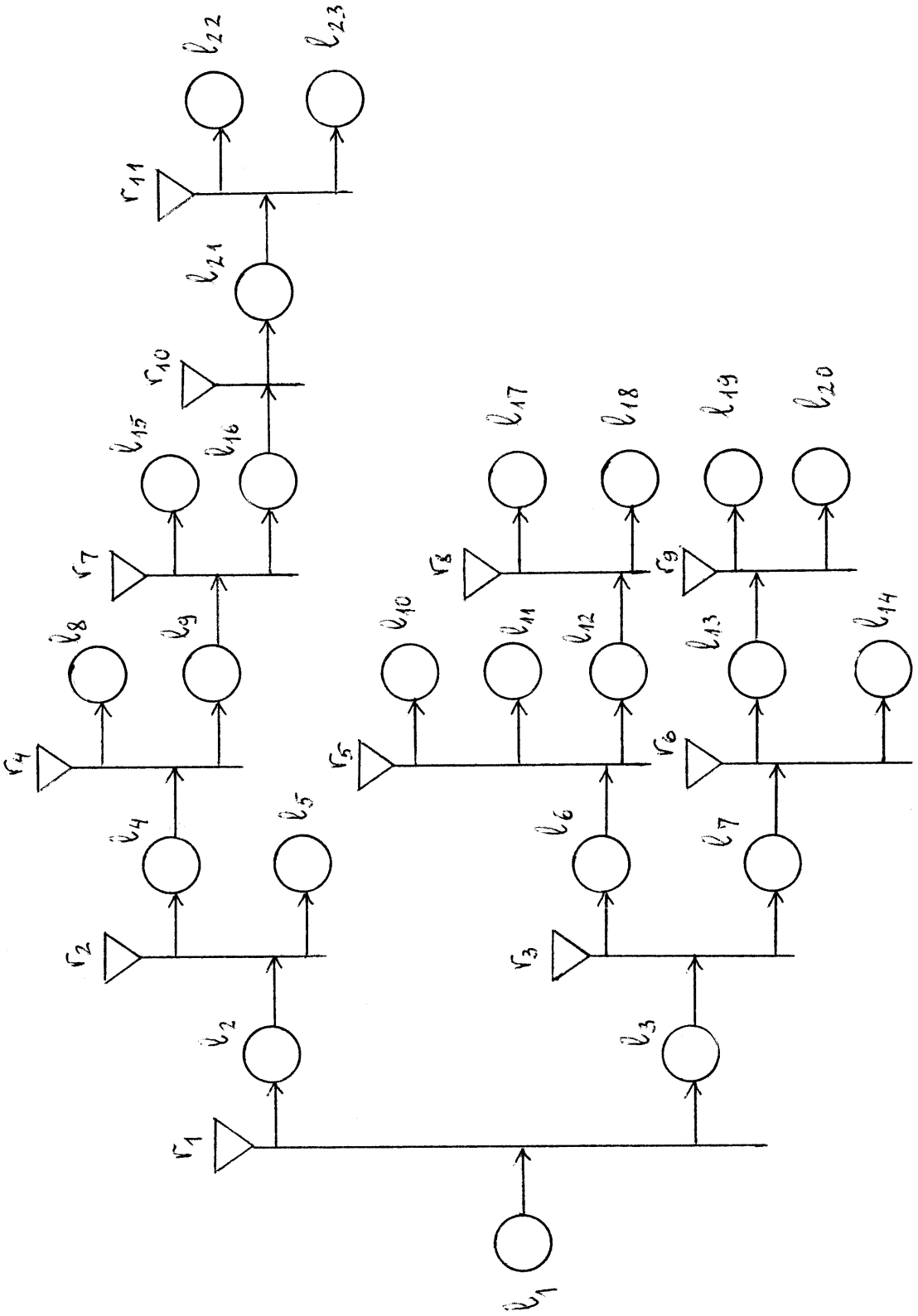
where

$$r_3 = \begin{array}{c|cc} & l_6 & l_7 \\ \hline l_3 & W_{3,6} & W_{3,7} \end{array}$$

where

$W_{3,6}$ = "there is unilateral pain",

$W_{3,7}$ = "there is bilateral pain".


l_1
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r_1
r_2
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r_4
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r_6
r_7
r_8
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r_{10}
r_{11}

Fig. 1.

The token does not obtain characteristics in places l_6 and l_7.

$$Z_4 = \langle \{l_4\}, \{l_8, l_9\}, r_4 \rangle,$$

where

$$r_4 = \begin{array}{c|cc} & l_8 & l_9 \\ \hline l_4 & W_{4,8} & W_{4,9} \end{array}$$

where

$W_{4,8}$ = "there is sinus disease",

$W_{4,9} = \neg W_{4,8}$.

If the token enters place l_8, then it obtains a characteristic "a consultation with a oto- rhino- laryngologist is necessary"; if the token enters place l_9, then it obtains a characteristic "check up of arterial hypertension"

$$Z_5 = \langle \{l_6\}, \{l_{10}, l_{11}, l_{12}\}, r_5 \rangle,$$

where

$$r_5 = \begin{array}{c|ccc} & l_{10} & l_{11} & l_{12} \\ \hline l_6 & W_{6,10} & W_{6,11} & W_{6,12} \end{array}$$

where

$W_{6,10}$ = "there is a temporal localization",

$W_{6,11}$ = "there is a periorbital pain",

$W_{6,12}$ = "there is an aura plus unilateral throbbing".

If the token enters place l_{10}, then it obtains a characteristic "temporomandibular joint disfunction or temporal arteritis"; if it enters place l_{11}, it obtains a characteristic "possible claster headache; a medical treatment must be carried out", and if it enters place l_{12}, it obtains a characteristic "migraine with aura"

$$Z_6 = \langle \{l_7\}, \{l_{13}, l_{14}\}, r_6 \rangle,$$

where

$$r_6 = \begin{array}{c|cc} & l_{13} & l_{14} \\ \hline l_7 & W_{7,13} & W_{7,14} \end{array}$$

where

$W_{7,13}$ = "there is a generalized or frontotemporal pain",

$W_{7,14}$ = "there is a neck and occiputal pain".

If the token enters place l_{13}, then it does not obtain a characteristic; if it enters place l_{14}, it obtains a characteristic "cervical spondylosis or arterial hypertension".

$$Z_7 = \langle \{l_9\}, \{l_{15}, l_{16}\}, r_7 \rangle,$$

where

$$r_7 = \begin{array}{c|cc} & l_{15} & l_{16} \\ \hline l_9 & W_{9,15} & W_{9,16} \end{array}$$

where

$W_{9,15}$ = "there is an elevated blood pressure",

$W_{9,16}$ = "there is a normal blood pressure".

If the token enters place l_{15}, then it obtains a characteristic "treat and observe"; if it enters place l_{16}, it obtains a characteristic "probable tension headache".

$$Z_8 = \langle \{l_{12}\}, \{l_{17}, l_{18}\}, r_8 \rangle,$$

where

$$r_8 = \begin{array}{c|cc} & l_{17} & l_{18} \\ \hline l_{12} & W_{12,17} & W_{12,18} \end{array}$$

where

$W_{12,17}$ = "the headache is frequent (daily to weekly)",

$W_{13,18}$ = "the headache is infrequent (1-2 per month or less)".

If the token enters place l_{17}, then it obtains a characteristic "prophylactic treatment of the attacks"; if it enters place l_{18}, it obtains a characteristic "treatment only during the attacks";

$$Z_9 = \langle \{l_{13}\}, \{l_{19}, l_{20}\}, r_9 \rangle,$$

where

$$r_9 = \begin{array}{c|cc} & l_{19} & l_{20} \\ \hline l_{13} & W_{13,19} & W_{13,20} \end{array}$$

where

$W_{13,19}$ = "the pain is throbbing",

$W_{13,20}$ = "there is a tight pressure".

If the token enters place l_{19}, then it obtains a characteristic "common migraine"; if it enters place l_{20}, it obtains a characteristic "tension headache".

$$Z_{10} = \langle \{l_{16}\}, \{l_{21}\}, r_{10} \rangle,$$

where

$$r_{10} = \begin{array}{c|c} & l_{21} \\ \hline l_{16} & \text{"true"} \end{array}$$

The token enters place l_{21} without conditions and obtains a characteristic "data of neurological examination".

$$Z_{11} = \langle \{l_{21}\}, \{l_{22}, l_{23}\}, r_{11} \rangle,$$

where

$$r_{11} = \begin{array}{c|cc} & l_{22} & l_{23} \\ \hline l_{21} & W_{21,22} & W_{21,23} \end{array}$$

where

$W_{21,22}$ = "the data of the neurological examination are normal",

$W_{21,23} = \neg W_{21,22}$.

If the token enters place l_{22}, then it obtains a characteristic "observe and treat conservatively"; if it enters place l_{23}, it obtains a characteristic "full neurological evaluation".

This GN is a sub-GN of the GNs discussed in [4-6].

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