Universität des Saarlandes
FR 6.2 Informatik

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Exercises for Limits of Computational Learning

http://www.mpi-inf.mpg.de/departments/d1/teaching/ss12/learning/

Assignment 8 Deadline: Thu 28.6.2012, 10am

Exercise 1 *(4pts) Show the following two statements.*

(a) $\mathbf{GConsEx} \not\subseteq \tau(\mathbf{Rel})\mathbf{GEx}$.

(b) $\tau(\mathbf{Rel})\mathbf{GEx} \not\subseteq \mathbf{GConsEx}$.

Exercise 2 *(4pts) Show the following two statements.*

(a) $\mathcal{T}\mathbf{Prud}(\mathbf{ItEx}) = \tau(\mathbf{T})\mathbf{GEx}$.[1]

(b) $\mathbf{Prud}(\mathbf{ItEx}) = \mathbf{ItTEx}$.

Exercise 3 *(4pts) Show that* $\tau(\mathbf{Rel})\mathbf{GEx}$ *is closed under (binary) union.*

Exercise 4 *(4pts) Show that* $\mathcal{R}\mathbf{GConsEx} \subset \mathbf{GConsEx}$.[2]

For extra credit, we explore *closure under constructive infinite union*. A learning criterion I is said to be *closed under constructive infinite union* iff, for all infinite lists of (programs for) learners $e \in \mathcal{R}$ with $\forall i : I(\varphi_{e(i)}) \neq \emptyset$ (all learners learn *something*), we have $\bigcup_{i\in\mathbb{N}} I(\varphi_{e(i)})$ is I-learnable.

Exercise 5 *(4pts extra credit, 2pts each)*

(a) $\tau(\mathbf{Rel})\mathbf{GEx}$ *is closed under constructive infinite union;*[3]

(b) $\tau(\mathbf{Confident})\mathbf{GEx}$ *is* not *closed under constructive infinite union.*

[1] Recall that $\tau(\mathbf{T})\mathbf{GEx} = \{\mathcal{S} \subseteq \mathcal{R} \mid \exists \mathcal{S}' \in \mathbb{U}\mathrm{Comp} : \mathcal{S} \subseteq \mathcal{S}'\}$.

[2] Note that a learner for $\mathcal{R}\mathbf{GConsEx}$ has to be total, that is, defined on all input, but it doesn't have to be consistent on all input, only on relevant input.

[3] If you successfully show this, then you do not have to submit a separate proof for Exercise 3.