**Prediction tools for kinases.** Tools, algorithms, link to the webpage or server of the prediction tools, databases that were used to train (and validate) the model.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tool | Algorithm | Link | Database | Predictive / Experimentally validated |
| PhosphoPredict | Random Forest (classification) | [PhosphoPredict](http://phosphopredict.erc.monash.edu/)  (Web page is not opening) | Phospho.ELM, PhosphoSitePlus | Experimentally validated, Experimentally validated |
| KinasePhos | Hidden Markov Models | [KinasePhos](http://kinasephos2.mbc.nctu.edu.tw/)  (Web page is not opening) | Phospho.ELM, Swiss-Prot | Experimentally validated, Experimentally validated |
| PPSP | Bayesian  Decision Theory | [PPSP](http://ppsp.biocuckoo.org/index.php) | Phospho.ELM | Experimentally validated |
| GPS | Logistic Regression | [GPS](http://gps.biocuckoo.cn/online.php) | PhosphoSitePlus | Experimentally validated |
| Musite | Support Vector Machines | [Musite](https://www.musite.net/) | Phospho.ELM, PhosPhAt, Swiss-Prot | Experimentally validated, Experimentally validated and Predictive, Experimentally validated |
| ~~ELM~~ |  | [~~ELM~~](http://elm.eu.org/) |  |  |
| ~~PROSITE~~ |  | [~~PROSITE~~](https://prosite.expasy.org/) |  |  |
| HPRD | - | [HPRD](http://www.hprd.org/)  (Service unavailable) | - | - |
| PostMod | Scoring system that includes noise reduction scheme utilizing indirect relationships | [PostMod](http://pbil.kaist.ac.kr/PostMod/) | Phospho.ELM | Experimentally validated |
| PSEA | Similarity score + Enrichment score ~ GSEA | [PSEA](http://bioinfo.ncu.edu.cn/PKPred_Home.aspx)  (Web page is not opening) | PhosphoSitePlus | Experimentally validated |
| NetPhosK | Artificial Neural Networks | [NetPhosK](https://services.healthtech.dtu.dk/service.php?NetPhos-3.1) | PhosphoBase | Experimentally validated |
| PredPhospho | Support Vector Machines | [PredPhospho](http://www.ngri.re.kr/proteo/PredPhospho.htm)  (Web page is not opening) | PhosphoBase | Experimentally validated |
| ~~PPRED~~ | ~~Support Vector Machines~~ | [~~PPRED~~](http://www.cse.univdhaka.edu/~ashis/ppred/index.php)  ~~(Web page is not opening)~~ | ~~Phospho.ELM~~ | ~~Experimentally validated~~ |
| CRPhos | Conditional Random Fields | [CRPhos](http://www.ptools.ua.ac.be/CRPhos/)  (Web page is not opening) | Phospho.ELM | Experimentally validated |
| NetworKIN | Artificial Neural Networks | [NetworKIN](https://networkin.info/) | Phospho.ELM | Experimentally validated |
| Li et. Al (paper) | Support Vector Machines | [huphospho](http://cmbi.bjmu.edu.cn/huphospho)  (Web page is not opening) | Phospho.ELM | Experimentally validated |
| ~~Scansite~~ |  | [~~Scansite~~](https://scansite4.mit.edu/#home) |  |  |
| KinomeXplorer | Naïve Bayes | [KinomeXplorer](http://35.193.15.54/) | Phospho.ELM | Experimentally validated |

1. Simple consensus pattern-based approaches
2. Sequence similarity-based methods
3. Advanced machine-learning algorithms

* The classification is based on the paper “PhosphoPredict: A bioinformatics tool for prediction of human kinase-specific phosphorylation substrates and sites by integrating heterogeneous feature selection”.
* ELM, PROSITE, PPRED and Scansite only predict phosphorylation sites and do not include protein kinases as well.
* HPRD is a database that integrates data manually from published articles.
* PhosphoBase has now moved to Phospho.ELM, but not at the time of NetPhosK development.
* PhosphoBase also included a scan of novel sites from the scientific literature and from a recent version of the Swiss-Prot database.
* Scansite primarily predicts phosphorylation sites in proteins and not protein kinase-substrate interactions. However, the tool also provides information on the likelihood of a given site being phosphorylated by specific protein kinases.