

CLAIMS

1. A method comprising:
 - training a pre-trained neural network that comprises:
 - an input layer;
 - a plurality of hidden layers, wherein each of the plurality of hidden layers has one or more nodes, wherein each of said one or more nodes has an associated weight trained based on data from a source domain; and
 - an output layer, wherein training the pre-trained neural network comprises:
 - introducing at least one additional layer to the plurality of hidden layers, wherein said additional layer has one or more nodes having associated weights;
 - keeping weights of the nodes in the plurality of hidden layers of the pre-trained neural network unchanged;
 - inputting data from a target domain to the input layer, wherein the data from the target domain comprises data having different characteristics from the source domain; and
 - adjusting weights of the one or more nodes in the at least one additional layer based on features obtained at the output layer, wherein the at least one additional layer is introduced to the pre-trained neural network in parallel with the last hidden layer of the pre-trained neural network, and wherein the method further comprises:
 - performing a concatenation of an output from the at least one additional layer and an output from the last hidden layer of the pre-trained neural network; and
 - passing on the concatenated outputs to the output layer.
2. The method as claimed in claim 1, wherein the at least one additional layer is introduced to the pre-trained neural network after the last hidden layer of the pre-trained neural network.
3. The method as claimed in any one of the preceding claims, further comprising:
 - selecting, from the features obtained at the output layer, a plurality of features with least training errors; and
 - adjusting weights of the one or more nodes in the at least one additional layer based on the selected plurality of features with least training errors.

4. The method as claimed in any one of the preceding claims, wherein the source domain is associated with a first country or geographical region and the target domain is associated with a second country or geographical region that is different from the first.
5. A system for training a neural network, comprising:
 - a processor module; and
 - a memory module including computer program code;
 - the memory module and the computer program code configured to, with the processor module, cause the system at least to:
 - retrieve, from the memory module, a pre-trained neural network comprising:
 - an input layer;
 - a plurality of hidden layers, wherein each of the plurality of hidden layers has one or more nodes, wherein each of the one or more nodes has an associated weight trained based on data from a source domain; and
 - an output layer;
 - introduce at least one additional layer to the plurality of hidden layers, wherein said additional layer has one or more nodes having associated weights;
 - keep weights of the nodes in the plurality of hidden layers of the pre-trained neural network unchanged;
 - input data from a target domain to the input layer, wherein the data from the target domain comprises data having different characteristics from the source domain; and
 - adjust weights of the one or more nodes in the at least one additional layer based on features obtained at the output layer, wherein the at least one additional layer is introduced to the pre-trained neural network in parallel with the last hidden layer of the pre-trained neural network, and wherein the system is further caused to:
 - perform a concatenation of an output from the at least one additional layer and an output from the last hidden layer of the pre-trained neural network; and
 - pass on the concatenated outputs to the output layer.
6. The system as claimed in claim 5, wherein the at least one additional layer is introduced to the pre-trained neural network after the last hidden layer of the pre-trained neural network.

7. The system as claimed in any one of claims 5 to 6, wherein the system is further caused to:

select, from the features obtained at the output layer, a plurality of features with least training errors; and

adjust weights of the one or more nodes in the at least one additional layer based on the selected plurality of features with least training errors.

8. The system as claimed in any one of the claims 5 to 7, wherein the source domain is associated with a first country or geographical region and the target domain is associated with a second country or geographical region that is different from the first.

9. A computer-implemented method, comprising:

inputting, via an input module, data from a target domain to an input layer of a pre-trained neural network, wherein the pre-trained neural network comprises:

a plurality of hidden layers, wherein each of the plurality of hidden layers has one or more nodes, wherein each of said one or more nodes has an associated weight trained based on data from a source domain, wherein the data from the source domain comprises data having different characteristics from the target domain; and

at least one additional layer introduced to the plurality of hidden layers, wherein said additional layer has one or more nodes having associated weights, and wherein the at least one additional layer is introduced to the pre-trained neural network in parallel with the last hidden layer of the pre-trained neural network;

obtaining, from an output module, features from an output layer of the pre-trained neural network;

configuring a processing module to adjust weights of the one or more nodes in the at least one additional layer based on the obtained features while keeping weights of the nodes in the plurality of hidden layers of the pre-trained neural network unchanged;

performing a concatenation of an output from the at least one additional layer and an output from the last hidden layer of the pre-trained neural network; and

passing on the concatenated outputs to the output layer.

10. An apparatus comprising:

an input module configured to receive data from a target domain;

a processing module configured feed the data to an input layer of a pre-trained neural network, wherein the pre-trained neural network comprises:

a plurality of hidden layers, wherein each of the plurality of hidden layers has one or more nodes, wherein each of said one or more nodes has an associated weight trained based on data from a source domain, wherein the data from the source domain comprises data having different characteristics from the target domain; and

at least one additional layer introduced to the plurality of hidden layers, wherein said additional layer has one or more nodes having associated weights, and wherein the at least one additional layer is introduced to the pre-trained neural network in parallel with the last hidden layer of the pre-trained neural network;

an output module configured to output features from an output layer of the pre-trained neural network, wherein

the processing module is further configured to:

- adjust weights of the one or more nodes in the at least one additional layer based on the outputted features while keeping weights of the nodes in the plurality of hidden layers of the pre-trained neural network unchanged;
- perform a concatenation of an output from the at least one additional layer and an output from the last hidden layer of the pre-trained neural network; and
- pass on the concatenated outputs to the output layer.